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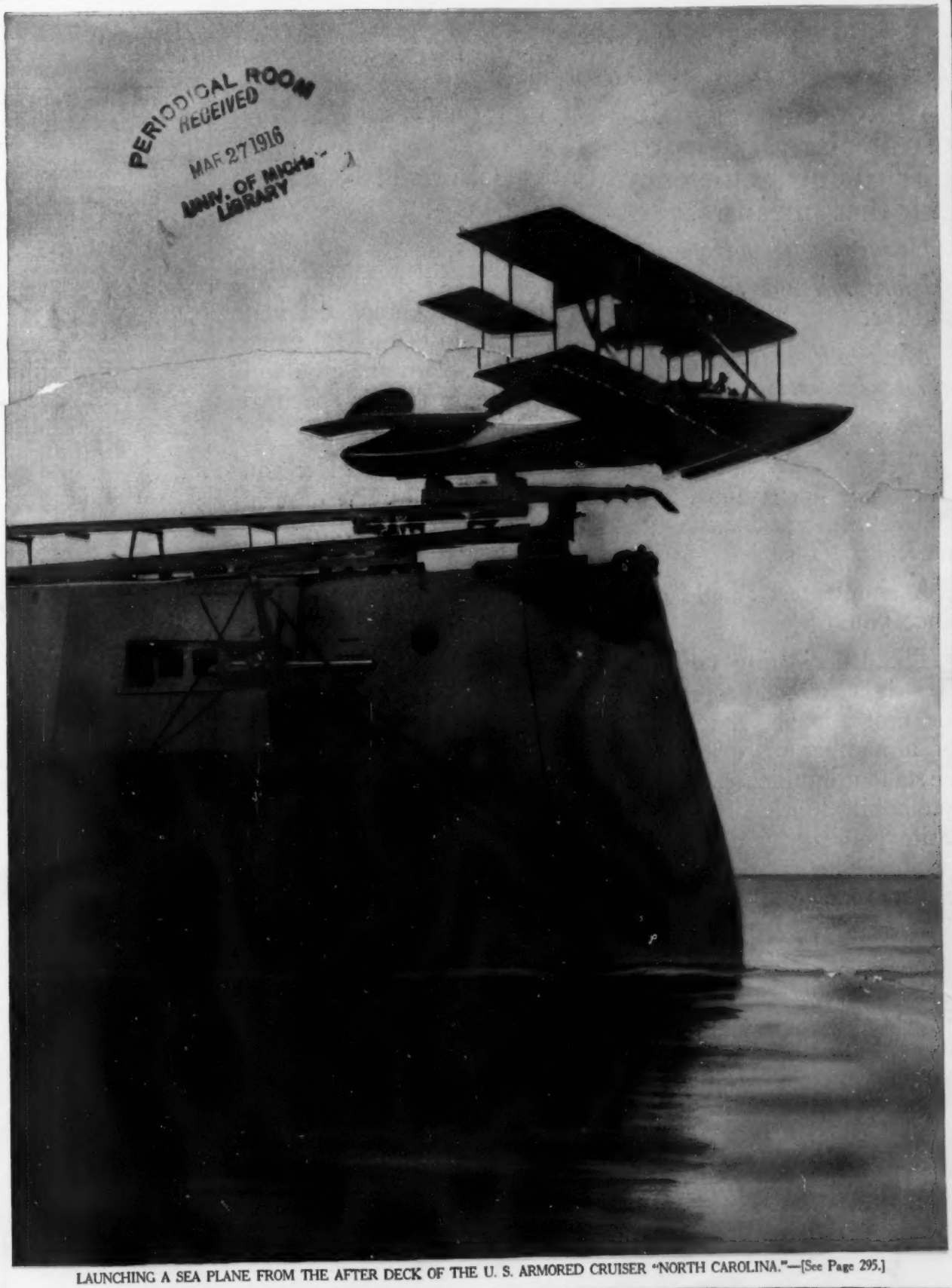


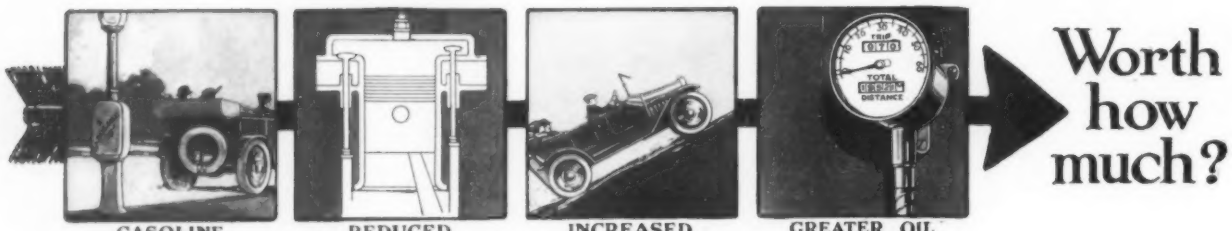
LAUNCHING A SEA PLANE FROM THE AFTER DECK OF THE U. S. ARMORED CRUISER "NORTH CAROLINA."—[See Page 295.]

March 18, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Motor Efficiency



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Worth how much?

Motor efficiency depends largely upon lubricating efficiency and that means:

Reduced carbon deposit.

More mileage from your gasoline.

More mileage from your lubricating oil.

Increased power.

There is only one way to experience for yourself the benefits from a really scientific lubricant. That is—*use it.*

A simple test should convince you.

The Lubricating Chart at the right which represents our professional advice, has, for a number of years been the standard guide to scientific automobile lubrication. Opposite your car you will find specified the correct oil for your motor.

That oil was specified for your motor after a careful scientific analysis of its lubricating requirements by the Vacuum Oil Company.

If your car is not listed, a copy of our complete Lubricating Chart will be sent on request.

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It will probably cost you less than $1.00 to fill your crank-case with the grade of Gargoyle Mobiloils specified for your car.

The garage or dealer you trade with has it, or can promptly secure it for you.

Ask him to empty your crank-case of its present oil and fill it with the correct grade of Gargoyle Mobiloils.

You can then judge for yourself the results in—increased power, reduced carbon deposit, gasoline economy, reduced oil consumption.

Is it not worth this nominal expenditure for you to discover for yourself these continuous benefits from using the oil specified for your car by a company whose unquestioned standing in engineering circles is world-wide?

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Mobiloils

A grade for each type of motor

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. For information, kindly address any inquiry to our nearest office.

VACUUM OIL COMPANY, - Rochester, N. Y., U. S. A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

Domestic Branches: Detroit New York Philadelphia Minneapolis Boston Chicago Indianapolis Pittsburgh Kansas City

Correct Automobile Lubrication

Explanation:—The four grades of Gargoyle Mobiloils, for gasoline motor lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A." "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1905	1906	1907	1908	1909
Abbott Detroit (8 cyl)	Arc	Arc	Arc	Arc	A
"	A	A	Arc	Arc	Arc
Acason (4 cyl)	Arc	Arc	Arc	Arc	Arc
" (6 cyl)	A	A	Arc	Arc	Arc
Adams-Farwell	A	A	A	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc
Autocar	A	Arc	A	Arc	A
Avery	A	A	A	A	A
" (Mod. 5 & 7 Ton)	Arc	Arc	Arc	Arc	Arc
Briscoe	A	Arc	A	Arc	A
" (8 cyl)	A	A	...	...	...
Buick	Arc	Arc	Arc	Arc	A
Cadillac	...	...	...	Arc	Arc
" (8 cyl)	A	A	Arc	Arc	...
Cartercar	...	...	Arc	Arc	Arc
" Con't	...	...	...	...	A
Case	A	A	A	Arc	A
Chalmers	Arc	Arc	Arc	A	A
" (Model 6-40)	A	Arc	...	...	...
" (Model 6-30)	A	A	...	...	...
Chandler Six	Arc	Arc	Arc	Arc	Arc
Chase (air)	B	B	B	B	B
" (water)	Arc	Arc	Arc	Arc	Arc
Chevrolet	Arc	Arc	Arc	Arc	A
Cole	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	...
Cunningham	...	...	Arc	Arc	Arc
Delaunay-Belleville	...	...	B	A	B
Detroiter	Arc	Arc	A	Arc	A
" (8 cyl)	...	...	Arc	Arc	...
Dodge	A	Arc	E	E	...
Empire	...	...	Arc	Arc	Arc
Federal	Arc	Arc	Arc	Arc	Arc
Fiat	B	A	B	A	B
Ford	E	E	E	E	E
Franklin	A	A	A	A	A
Grant	A	Arc	Arc	Arc	Arc
Haynes	A	Arc	A	Arc	A
" (12 cyl)	A	A	...	...	...
Hudson	Arc	Arc	Arc	Arc	Arc
" Super Six	A	A	...	...	...
Hupmobile	A	Arc	A	Arc	A
L H C (air)	...	...	B	A	B
" (water, 2 cycle	A	A	A	A	A
" (water, 4 cycle	A	Arc	...	...	...
Interstate	...	...	A	Arc	A
Jackson	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Jeffery	A	Arc	A	Arc	A
" (Chesterfield)	A	Arc	A	Arc	...
" Con't	A	Arc	A	Arc	Arc
Kelly Springfield	A	A	A	A	A
King	...	...	A	Arc	A
" (8 cyl)	A	A	Arc	Arc	...
" Con't	Arc	Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A
" Con't	A	Arc	A	Arc	A
" (Model 48)	A	A	A	A	A
Kline Kar	Arc	Arc	A	Arc	A
Knox	B	A	B	A	B
" (Model 35)	A	A	A	A	...
Locomobile	E	E	E	E	E
Lozier	A	Arc	A	Arc	A
Marion	A	Arc	Arc	Arc	Arc
Marmon	A	A	A	Arc	A
Maxwell	Arc	Arc	Arc	Arc	Arc
Mercer	...	...	A	Arc	A
" (22-70)	...	...	Arc	Arc	...
" (22-72)	A	A	...	...	...
Metz	A	Arc	A	Arc	A
Mitchell	A	Arc	A	Arc	A
" (8 cyl)	A	A	...	...	...
Moline	...	...	...	...	A
" Knight	A	A	A	A	A
Moon (4 cyl)	...	...	Arc	Arc	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc
National	A	Arc	A	Arc	A
" (12 cyl)	A	A	...	...	...
Oakland	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Oldsmobile	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Overland	Arc	Arc	Arc	Arc	Arc
Packard	...	...	A	Arc	A
" (12 cyl)	A	A	...	...	...
" Con't	A	A	A	A	...
Paige	...	...	A	Arc	A
" (6-46)	Arc	Arc	Arc	Arc	...
" (6-36 & 38)	A	Arc	A	Arc	...
Pathfinder	Arc	Arc	Arc	Arc	Arc
" (12 cyl)	A	A	...	...	...
Peerless	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Pierce Arrow	A	A	Arc	Arc	Arc
" " Con't	Arc	Arc	Arc	Arc	Arc
Premier	A	Arc	A	Arc	A
Pullman	Arc	Arc	Arc	Arc	Arc
Regal	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	Arc	Arc	...
Renault	A	Arc	A	Arc	A
Reo	A	Arc	A	Arc	A
Richmond	Arc	Arc	A	Arc	A
S. G. V.	...	...	A	Arc	A
Saxon	E	E	E	E	E
Scripps Booth (air)	...	...	...	B	A
" (water)	A	Arc	E	E	...
" (8-cyl)	A	A	...	...	...
Seldon	Arc	Arc	Arc	Arc	Arc
Simplex	A	A	Arc	Arc	Arc
Stearns Knight	B	A	B	A	B
" " 6 cyl	B	A	...	...	...
Stevens Duryea	...	...	Arc	Arc	Arc
Studebaker	A	Arc	Arc	Arc	A
Stutz	A	A	A	A	A
Velie (4 cyl)	...	...	A	Arc	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc
Willys Knight	B	A	B	A	A
Winton	Arc	Arc	Arc	Arc	Arc

MODEL OF CARS	1910	1911	1912	1913	1914
Abbott Detroit (8 cyl)	A	Arc	A	Arc	Arc
"	Arc	Arc	Arc	Arc	Arc
Acason (4 cyl)	Arc	Arc	Arc	Arc	Arc
" (6 cyl)	A	A	A	A	A
Adams-Farwell	A	A	A	A	A
" (6 cyl)	Arc	Arc	Arc	Arc	...
Autocar	A	Arc	A	Arc	Arc
Avery	A	A	A	A	A
" (Mod. 5 & 7 Ton)	Arc	Arc	Arc	Arc	...
Briscoe	A	Arc	A	Arc	...
" (8 cyl)	...	...	...	...	...
Buick	Arc	Arc	Arc	Arc	Arc
Cadillac	...	...	Arc	Arc	Arc
" (8 cyl)	A	A	Arc	Arc	...
Cartercar	...	...	Arc	Arc	Arc
" Con't	...	...	...	A	A
Case	A	A	A	Arc	A
Chalmers	Arc	Arc	Arc	A	A
" (Model 6-40)	A	Arc	...	...	...
" (Model 6-30)	A	A	...	...	...
Chandler Six	Arc	Arc	Arc	Arc	Arc
Chase (air)	B	B	B	B	B
" (water)	Arc	Arc	Arc	Arc	...
Chevrolet	Arc	Arc	Arc	A	A
Cole	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	A	A	...
Cunningham	...	...	Arc	Arc	Arc
Delaunay-Belleville	...	...	B	A	B
Detroiter	Arc	Arc	A	A	A
" (8 cyl)	...	...	Arc	Arc	...
Dodge	A	Arc	E	E	...
Empire	...	...	Arc	Arc	Arc
Federal	Arc	Arc	Arc	Arc	Arc
Fiat	B	A	B	A	B
Ford	E	E	E	E	E
Franklin	A	A	A	A	A
Grant	A	Arc	Arc	Arc	Arc
Haynes	A	Arc	A	Arc	A
" (12 cyl)	A	A	...	...	...
Hudson	Arc	Arc	Arc	Arc	Arc
" Super Six	A	A	...	...	...
Hupmobile	A	Arc	A	Arc	A
L H C (air)	...	...	B	A	B
" (water, 2 cycle	A	A	A	A	A
" (water, 4 cycle	A	Arc	...	...	...
Interstate	...	...	A	Arc	A
Jackson	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Jeffery	A	Arc	A	Arc	A
" (Chesterfield)	A	Arc	A	Arc	...
" Con't	A	Arc	A	Arc	Arc
Kelly Springfield	A	A	A	A	A
King	...	...	A	Arc	A
" (8 cyl)	A	A	Arc	Arc	...
" Con't	Arc	Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A
" Con't	A	Arc	A	Arc	A
" (Model 48)	A	A	A	A	A
Kline Kar	Arc	Arc	A	Arc	Arc
Knox	B	A	B	A	B
" (Model 35)	A	A	A	A	...
Locomobile	E	E	E	E	E
Lozier	A	Arc	A	Arc	Arc
Marion	A	Arc	Arc	Arc	Arc
Marmon	A	A	A	Arc	A
Maxwell	Arc	Arc	Arc	Arc	Arc
Mercer	...	...	A	Arc	A
" (22-70)	...	...	Arc	Arc	...
" (22-72)	A	A	...	...	...
Metz	A	Arc	A	Arc	A
Mitchell	A	Arc	A	Arc	A
" (8 cyl)	A	A	...	...	...
Moline	...	...	...	...	A
" Knight	A	A	A	A	A
Moon (4 cyl)	...	...	Arc	Arc	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc
National	A	Arc	A	Arc	A
" (12 cyl)	A	A	...	...	...
Oakland	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Oldsmobile	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	...	...	...
Overland	Arc	Arc	Arc	Arc	Arc
Packard	...	...	A	Arc	A
" (12 cyl)	A	A	...	...	...
" Con't	A	A	A	A	...
Paige	...	...	A	Arc	A
" (6-46)	Arc	Arc	Arc	Arc	...
" (6-36 & 38)	A	Arc	A	Arc	...
Pathfinder	Arc	Arc	Arc	Arc	Arc
" (12 cyl)	A	A	...	...	...
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Pullman	Arc	Arc	Arc	Arc	Arc
Regal	Arc	Arc	Arc	Arc	Arc
" (8 cyl)	A	A	Arc	Arc	...
Renault	A	Arc	A	Arc	A
Reo	A	Arc	A	Arc	A
Richmond	Arc	Arc	A	Arc	A
S. G. V.	...	...	A	Arc	A
Saxon	E	E	E	E	E
Scripps Booth (air)	...	...	...	B	A
" (water)	A	Arc	E	E	...
" (8-cyl)	A	A	...	...	...
Seldon	Arc	Arc	Arc	Arc	Arc
Simplex	A	A	Arc	Arc	Arc
Stearns Knight	B	A	B	A	B
" " 6 cyl	B	A	...	...	...
Stevens Duryea	...	...	Arc	Arc	Arc
Studebaker	A	Arc	Arc	Arc	A
Stutz	A	A	A	A	A
Velie (4 cyl)	...	...	A	Arc	A
" (6 cyl)	Arc	Arc	Arc	Arc	Arc
White	Arc	Arc	Arc	Arc	Arc
Willys Knight	B	A	B	A	A
Winton	Arc	Arc	Arc	Arc	Arc

Electric Vehicles—For motor bearings and enclosed chains use Gargoyle Mobiloil "A" the year around. For open chains and differential, use Gargoyle Mobiloil "C" the year around. Exception—For *winter lubrication* of pleasure cars use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.

SEVENTY-SECOND YEAR

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Widening the Range of the Fleet's Eyes By Means of the Aeroplane Catapult

By Robert G. Skerrett

EVEN the layman knows to-day that aircraft have materially altered the problems of military strategy. He knows that they have done this by reason of their ability to speed about aloft and to watch with measurable safety the movements of a foe and the distribution and kinds of forces at his command. In short, the aeroplane has permitted spying from high in the air.

Just what has thus been done for armies in the field will, in the near future, be done for battle fleets or squadrons. The naval air pilot will become an invaluable aid to an admiral in planning how best to meet his foe or how, if that be the wiser course, to avoid an engagement with the enemy's fighting ships. All of this may sound trite, but such is not the fact among men familiar with the limitations imposed upon naval aviation until of late.

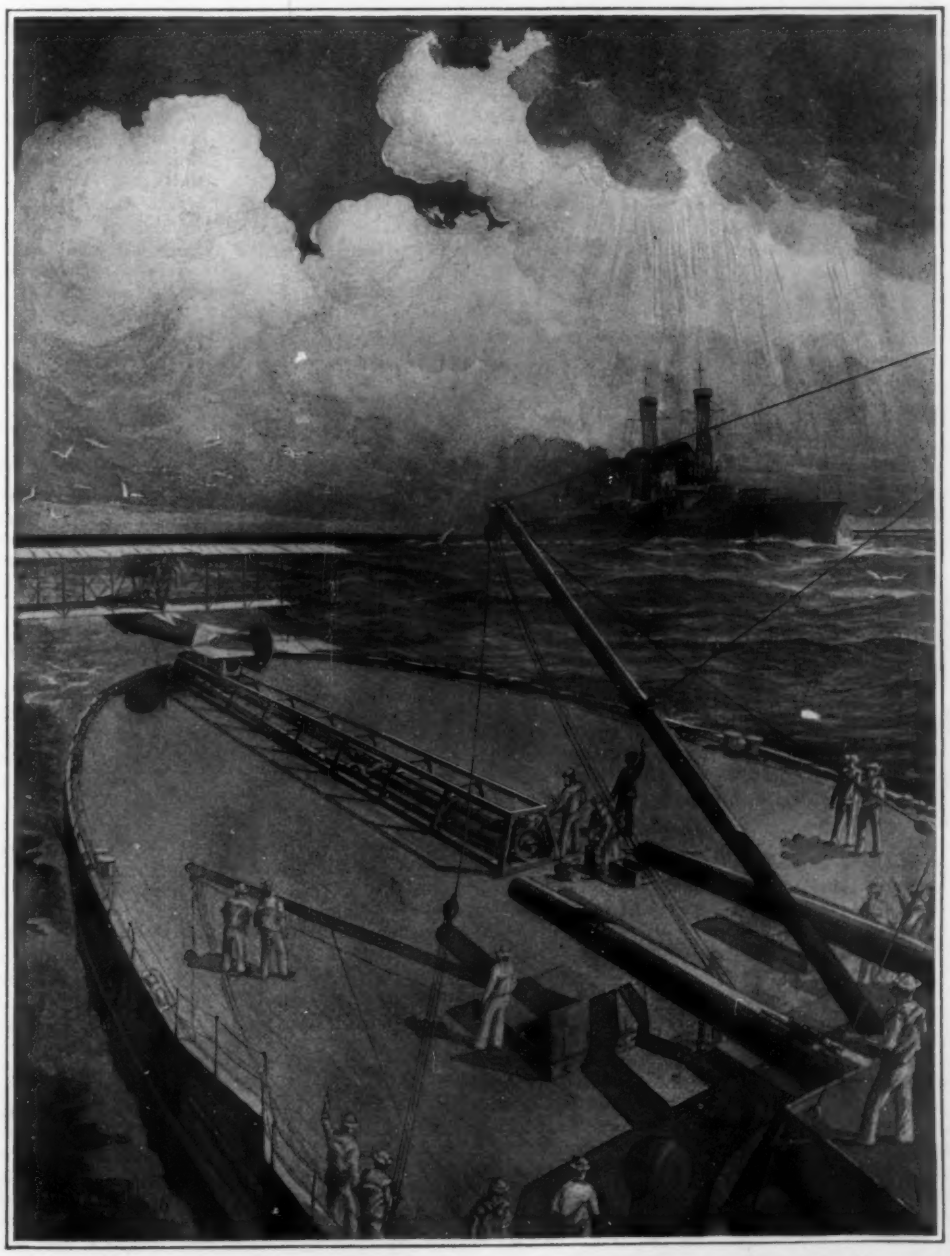
The seaplane as a naval scout should be able to operate from a moving ship as a base, and to do this with much the same indifference to the state of the weather as its fellow in the military service, starting aloft from the ground. Otherwise its nautical usefulness would in no way be comparable with that so splendidly discharged by aircraft in the army. The stumbling block has been very largely the seaplane's inability to get a start from rough waters. The sturdiest of them are able to land upon something of a troubled sea, but their pontoons do not permit them to gain sufficient speed under those circumstances to insure the take-off for a flight. Therefore, even though they might be put overboard safely in the lee of a ship it has not been possible, except under the most favorable conditions of the water, to get them away in flight.

But this difficulty has been surmounted here, thanks to the initial work of Captain Washington I. Chambers, U. S. N., who gave us the idea of a catapult launching apparatus for naval aircraft. As a practical naval man, this officer realized that no fighting ship could afford to be encumbered with long launching platforms such as were tried first here and then experimented with abroad. He knew that space must be economized and the sweep of guns uninterrupted. Therefore he conceived a short-run catapulting railway that could be quickly erected and just as rapidly dismantled and stored away. His first apparatus was tested over three years ago at the Washington Navy Yard, and as an outcome of those promising experiments a new machine was designed and sent to the Aeronautic Station, Pensacola, Florida.

There it was installed at the start upon a coal barge and thoroughly tried out. As a result of its success the apparatus was removed and placed permanently aboard the U. S. S. "North Carolina." It is from this ship that seaplanes have repeatedly been launched in the past few weeks in the open sea and with the armored cruiser underway. Despite the fact that one of the older and heaviest of the service aeroplanes has been used in these trials, still the catapult has answered admirably and has taken care of the load imposed upon it again and again. This point is suggestive, because the weight factor may be taken to represent either a long-range scout or a lighter seaplane equipped with bomb-dropping apparatus.

In principle, the launching device consists fundamentally of a car propelled along a narrow-gage track. Upon this car rests the seaplane, and the aircraft is secured to the vehicle until the latter reaches the end of the runway. When the car stops the seaplane is automatically released, and the acquired inertia suffices to sustain the flying machine until its propellers are able to provide the necessary propulsive effort. As a rule, however, the aircraft's motors will be speeded up to this point by the time the end of the track is reached. The method of operating is as follows: The 'plane is lifted onto the car and secured to it, then the motors are set going but not at full speed. This is accelerated after the catapulting begins. The aviator takes his seat in his craft, and when everything is in readiness the car, with its load, is drawn along the track at an increasing rate. This gathering momentum is so nicely controlled that a velocity of about 50 miles an hour is attained by the time the aeroplane is cast loose from the car. The car is brought to a standstill a very few seconds later.

Originally, the truck was sent overboard at the end of its run, but in service aboard a ship underway at sea this would be undesirable, because it would be necessary either to stop or slacken speed in order to haul the car aboard even if it were held by a line. Clearly it would be impracticable to abandon the truck and to hold in reserve any number of them. The motive power employed for moving and speeding up the catapult car is compressed air. By means of a throttle worked by a cam, the air impulse is progressively increased upon the operative piston or plunger which functions the wire rope purchase by which the truck is pulled during its comparatively short run of something less than 50 feet. The actual stroke of the piston is in the neighborhood of one inch for each foot of advance on the part of the truck; the turns of the wire rope over pulleys serving to produce this multiplication of movement. The air required by the catapult is supplied from the torpedo air service of the cruiser and at a pressure of something like 300 pounds per square inch.



The seaplane launching mechanism used on the U. S. armored cruiser "North Carolina"

The runway is made up of light steel angle iron and raised only three feet or so above the ship's deck, to which the structure is secured by attachments that can be quickly released when it is desired to dismount the apparatus. The aviator is not jarred during the acceleration of the car and the final catapulting of the seaplane. The only sensation on the part of the pilot is like that due to a sudden blast of air in the face. The trials so far have been conducted with the "North Carolina" steaming along at cruising speed.

A scout cruiser is capable of covering a visual front of but 20 miles under favorable conditions of the atmosphere. An air scout 4,000 feet aloft can observe **ships 70 miles away!** There is no need of elaborating upon the strategic advantage obtained by the use of scouting seaplanes. It is just this widened field of observation which the aeroplane catapult makes possible.

A Study of Fog At Sea

ACCORDING to the last annual report of the U. S. Bureau of Standards, a preliminary investigation of the properties of fog at sea formed part of the programme of work carried out on the last ice patrol of the Coast Guard cutter "Seneca." A study was made of the number of condensation nuclei in the sea air, and also of the amount of liquid in the fog particles.

SCIENTIFIC AMERICAN

Founded 1845

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Charles Allen Munn, President, Frederick C. Beach, Secretary, Orson D. Munn, Treasurer, all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Merit in Place of Politics

ABSOLUTELY the most important institution embraced under the comprehensive term "naval defenses" is the Naval Academy at Annapolis. To this institution are sent the young men of America who (presumably because of their inherent fitness for the task) have been selected to control the country's outermost defenses, its far-flung line of battle on the high seas. So enormous is the responsibility which rests upon the shoulders of a naval officer that the average American citizen would naturally suppose that each contingent of young men, as it is selected year by year and sent to Annapolis, is chosen solely on the ground of its physical, mental and moral fitness for the arduous duties and high national responsibilities of a naval officer. This would imply, of course, selection by a system of searching, competitive examination.

As a matter of fact, with a few exceptions, no such system of selection exists. On the contrary, the success of the candidates is dependent, in the majority of cases, upon the political exigencies with which our senators and representatives find themselves confronted when they make their annual selection of young men for Annapolis and West Point; for it is a lamentable fact that, more often than not, the selection of the candidates for the enormously important duties of the naval and military officer is entirely in the hands of the professional politician.

Nor does the influence of politics end with the appointment of the cadet, nor even with his failure. "The powerful political hand," says the Conference Committee on National Preparedness, "that puts a young man into either Academy (Annapolis or West Point) may often be raised to keep him there after he has been tried and found wanting. At times a twenty-five cent telegram may set all the machinery of a vast political organization into motion to save a failure from dismissal."

Now, such conditions are nothing less than scandalous. The Congressman who recommends a young man to the Academy on any other grounds than his fitness therefor is guilty of an act that is highly unpatriotic. We will go further and say that the Congressman who will set in motion political enginery to save a discredited youth from dismissal is guilty of that which, in the spirit if not in the letter, is perilously near to high treason.

Some of our Congressmen, it is true, are fully alive to the need for competitive examinations, and the young men of their districts enter Annapolis and West Point only through that straight and narrow door; but the practice should be made obligatory and universal. In his annual report for 1913, Colonel C. P. Townsley of West Point says: "These cadetships belong to the people of the District, State, Territory, etc., and should be open competitively to all the youths eligible to compete, and it is my recommendation that a law be enacted requiring competitive examinations to be held for each vacancy, that youth to be appointed who passes successfully the best mental examination, and who is physically and morally qualified. The examination questions should be prepared by the Academic Board, and a successful passing of the competitive examination should qualify a youth to enter, so that no other mental examination need be required. The details of conducting such examinations should, I think, be left to the Secretary of War. By announcing in the local papers some ten months or a year in advance that such a competitive examination will be held, stating its scope, it is believed that there will be a large number of eligible youths who will present themselves for examination in each district from which a vacancy is to be filled."

We commend this matter, as being one of the most vital affecting national preparedness, to the thoughtful consideration of every congressional district throughout the country. At once and absolutely, the matter of the selection of young men for the high duties of the naval and military officer should be lifted out of the dubious field of politics.

War and the Nitrogen Supply

HAD Germany not made provision for obtaining nitrogen from the air before the outbreak of the war, it is probable that her resistance would have collapsed many months ago for lack of powder and high explosives. With that far-sightedness which is one of the most conspicuous elements of her efficiency, she set her chemists to work, long ago, searching for some artificial means for supplying nitrogen, which would render the country independent of the Chilean deposits, hitherto the great source of supply. Germany has recently announced that she is today independent of outside sources, and that she can keep her powder factories going indefinitely in spite of the British blockade.

One of the most important investigations undertaken by the Naval Consulting Board is that directed to the question of a supply of nitrogen for the naval and military needs of the United States. The Chairman of the Committee of Physics and Chemistry has presented a report embodying the result of a joint investigation by itself and the Committee on Ordnance and Explosives, and has sent the Navy Department a resolution to the effect that the synthetic production of nitrogen products is immediately vital to the agricultural and military interests of the United States. The Secretary of the Navy is requested to urge upon the President that he coördinate the efforts to make effective the synthetic production of nitrogen in this country by the creation of a committee, which shall include representatives of the Departments of Agriculture and the Interior and the Army and Navy Departments, to study the question and report on the same at the earliest possible moment.

In all the present discussions on preparedness it is certain that there are some things which can be done, or at least started, immediately; among these, and perhaps most important of them all, is this question of making the country independent of the Chilean nitrate deposits. It is no exaggeration to say that upon the quick solution of this problem may depend the fate of the nation.

Arctic Controversies

IN another column of this issue we publish a letter from Mr. Edwin Swift Balch, a writer whose views on polar questions always command respectful attention. From time to time in the past we have commented on Mr. Balch's efforts to reverse the judgment of the world regarding Dr. Cook. His arguments are an eloquent presentation of the conservative attitude that, although Cook's claims have never been verified, they have never been disproved, coupled with suggestions as to ways in which future exploration may either, on the one hand, give greater plausibility to them, or, on the other, effectually discredit them. Cook has had other respectable champions, and some of them have not been so conservative in their championship as Mr. Balch. There are, for example, certain German geographers of good standing who to this day habitually speak of the conquest of the pole "by Cook and Peary." Cook has had some staunch supporters in congress.

The Cook-Peary controversy has, however, been a particularly distasteful chapter in the history of American science, and this journal would be loth to do anything toward perpetuating it. There are probably very few geographers who doubt that Peary reached the pole. Attempts have been made to minimize the value of the scientific work carried out by his expedition; but it should be remembered that a journey of hundreds of miles over a frozen ocean in quest of a definite goal, during the brief season when daylight and the state of the ice make such a journey possible, is necessarily a hasty affair, and affords little opportunity for elaborate scientific observations. Such data as Peary obtained were frankly and promptly submitted to competent authorities on his return to civilization, and the record of his journey bears the earmarks of being a straightforward narrative.

On the contrary, Cook's extraordinary gyrations, from the time he arrived in Copenhagen minus his records down to his recent press-agent methods of arousing public sympathy in his behalf, inspire neither respect nor confidence. Even while reserving judgment as to the possibility that he got to the pole, one is inclined to hope that he did not.

It so happens that the speech by Representative Helgesen to which Mr. Balch refers has no direct bearing upon the polar controversy, and does not even mention Dr. Cook. Mr. Helgesen's remarks are primarily a criticism of the geographical work done by Peary on several of his expeditions, and of the U. S. Hydrographic Office for incorporating in its charts data some of which were questionable while others had been definitely proven erroneous. Mr. Helgesen's long speech is an interesting scientific document, and one that we should like to see reproduced in a geographical journal. He raises several questions the ventilation of which would be much more profitable than a revival of the question "Who discovered the north pole?"

The last paragraph of Mr. Balch's letter calls attention to an interesting exploit that appears to have been overlooked by the geographical journals and the newspapers.

A Heat Standard for Gas

THE recent decision of the Public Service Commission for the First District of the State of New York, to substitute a heating value standard for illuminating and fuel gas in place of the present candle power standard, is in line with modern developments in gas technology and will aid in securing a better basis for regulation, fair to both consumer and manufacturer. With the widespread use of gas for cooking, heating, and power in various domestic and industrial applications, its heat value is, of course, an important element, while with the increased and all-but-universal employment of the incandescent mantle burner, the illuminating power of the gas itself has become subordinate to its heating power.

Of course, in the early days of the manufacture of illuminating gas, when open burners were used exclusively, and when the gas stove or range was hardly thought of, it was necessary to demand that the gas furnished possess a specified candle power and that it should be so made or enriched with oil rich in hydrocarbons as to burn with a flame brilliant enough to afford the desired degree of illumination. As this enrichment of the gas involved considerable expense to the gas company, it was of course necessary to maintain by legal standard the quality of the supply. This was particularly the case in connection with water gas, where by passing steam over a bed of incandescent coal or coke the hydrogen is separated from the oxygen which combines with the carbon of the coal to furnish CO, both of these gases being combustible but not affording a luminous flame until mixed with a gas made from petroleum oil. With coal gas produced by the distillation of coal in a retort, there is less need of the enrichment, but even here this gas often needs to be brought to a proper standard of illuminating power for use with open burners. The introduction of the incandescent mantle in gas lighting has wrought many changes in the gas industry and has become general. Open-flame burners, relatively, are so few that now it is hardly necessary for the luminous quality of the gas to be considered, though there are certain uses for which the open-flame burner is well adapted. If a candle-power standard is maintained it may result that the gas can be so enriched that it will not give the best service with mantles, not to mention its fuel functions, while if the gas is too poor it is, of course, undesirable for open flames.

In this connection it is interesting to note that when the gas pressure exceeds a certain limit there is not a corresponding increase of candle power in the naked flame burner. But the householder who uses gas for heating purposes (by which we mean to include the heating of gas mantles), will receive light from his burner and heat from his range in proportion to the readings of his gas meter, regardless of fluctuations of pressure.

The United States Bureau of Standards for several years has given considerable attention to the matter of standards for gas service, and it has reached the conclusion that there is no question that the heating-value standard is superior to candle-power regulation. The Bureau recommends that a heating value standard be maintained with, however, a minimum standard of candle power, say 12 to 15 candles, as a secondary standard for the benefit of the minority of open-burner users. This, of course, would present no hardship, as most gases as made by the ordinary processes now in use would comply with such a nominal candle-power regulation. The proposed change in New York it is believed will make for better service, as gas of high heating value can be made more efficiently and be distributed with smaller losses in heating value, and with less effects from abnormal weather conditions. This should give better and more economical service to the consumer; for gases of nearly normal heat value but very low candle power are now available, and these can be supplied at a reasonable price if the illuminating value of the gas may be neglected.

Instead of the photometer, with which daily tests of the gas of New York city are made to determine whether when burning at a burner which consumes five cubic feet an hour, the legal standard of 22 candle power is realized, the Public Service Commission now proposes to have a number of testing stations where calorimeters will be installed and the gas tested for its heat value measured in terms of British heat units. In American gas practice the average heating value runs about 620 B.T.U. per cubic foot, and the average candle power about 19.5. The usual heating value required by the various state and city regulations is 600 B.T.U., and an increasing number of commissions, both state and city, are now making their requirements on this more practical basis.

Naval and Military Notes

Terrific German Howitzer Fire.—Never in the history of artillery has there been witnessed such a concentration of heavy shell-fire as was rained down upon the French positions during the recent attacks on Verdun. A French officer speaks of the great rapidity of the gunfire, likening it in this respect to that of the French direct-fire artillery. It is probable that the bulk of the work has been done by the highly mobile and very effective Krupp howitzer of 8.2-inch calibre.

American Naval Gunnery.—Testifying before a congressional committee, Admiral Fletcher gave it as his opinion that from 10 to 20 per cent of the shots fired from an American battleship would land on an enemy at 18,000 yards, this estimate being based on the recent target practice at Guantanamo. He stated that his flagship, the "Wyoming," in target work at 12,000 yards had put three 12-inch shells through a 10-inch armor plate.

The Fulfilment of Russia's Dream?—Among the dramatic surprises of the war, of which there have been not a few, the swift capture of Erzerum and the equally swift descent of the Russian troops into Asiatic Turkey must always be conspicuous. The campaign in the Caucasus, hitherto regarded as insignificant, may yet prove to be the means by which Russia will realize her age-long dream of a port on the warm seas, open the year round for her incoming and outgoing seaborne trade.

Preparedness in 1891.—There was brought into this office the other day a blue-print of an American-type box car designed and built by an American firm to the order of the German government for use on the State railways. Although they were built twenty-five years ago, provision was made for placing a line of railway station benches, back to back, down the center of each car, and folding benches were shown down each side and across the end of the car. Thus Germany in 1891 prepared for the swift mobilization of 1914.

Trials of Our Latest Dreadnought.—The "Pennsylvania," our first ship to carry twelve 14-inch guns, recently went through her high-speed trials satisfactorily, averaging for some hours one half a knot above her contract speed of 21 knots. In gun power, and particularly in armor, the "Pennsylvania" may be considered to outmatch the latest dreadnoughts of other powers; but her speed, having in mind what the other people are doing, is lamentably low; in proof of which consider the 25-knot British "Queen Elizabeth," the 23-knot Russian "Gongort," and the 22.5-knot Italian "Caio Duilio."

To Shoot Across the Channel.—A dispatch from Berlin credits Professor Rausenberger with the statement that artillery will be built of such great size that it will be able to bombard England across the Channel; but it would not be necessary to increase the size of the gun to secure the necessary range of 21 miles. There are existing guns—plenty of them—that can cover far greater distances than that. Many years ago Colonel Ingalls, in calculating the ballistics of the Brown 10-inch wire-wound gun of 4,000 foot-seconds velocity, found that at 45 degrees elevation the shell would be thrown a distance of 49 miles, and that, during its flight, it would rise 18 miles into the air.

British Navy 1,000,000 Tons Larger.—The First Lord of the Admiralty, Balfour, states that the tonnage of the British navy has been increased by 1,000,000 tons since the outbreak of the war. If so, we cannot understand into what kind of ships this great displacement has gone. The 14 dreadnoughts which have been added would not account for one half of that total, and what the other half is made up of it is difficult to imagine, although there has been a great increase in the number of light cruisers, destroyers and submarines. It will probably be found that the new monitor fleet is larger than was supposed; furthermore, in all likelihood, the 1,000,000 tons covers the auxiliary ships taken over by the government.

Frontal Attack in the Present War.—In the years preceding the war we were told that so murderous would be the combined artillery, machine-gun and rifle fire from an entrenched position that no troops in the world would attempt a frontal attack. The war has proved the very contrary. Indeed, the present gigantic struggle for the capture of Verdun has consisted, so far as the German infantry is concerned, of little else but frontal attacks against what are probably the most completely defended positions in the world. It is probable that since the early history of warfare troops have never been subjected to such a frightful ordeal as the dense masses of German infantry which have stormed, or attempted to storm, the outlying Verdun positions. The High Command of the German army knows what it is about; but the average layman is beginning to ask himself how long the German army can last if its numbers are to be reduced through the coming spring and summer at the rate of wastage in the Verdun battle.

Science

Farmers' Bulletins issued by the U. S. Department of Agriculture during the last fiscal year numbered 14,795,000 copies, which was slightly less than the number issued in 1914, but far greater than in any previous year. The number of new bulletins of this series issued in 1915 was 77, a much greater number than in any previous year. In addition, 243 old bulletins were reprinted.

The Hessian Fly Outbreak of last spring was one of the severest on record, according to the U. S. Bureau of Entomology. Starting in northern Oklahoma and Kansas, the infestation swept over the wheat belt northward and eastward, doing most of its damage, however, west of the Mississippi and north of the Ohio and Potomac Rivers. Several publications were issued during the year warning farmers of the impending outbreak and giving them advice relative to the management of their fields in such a way as to reduce the damage. Of a single circular nearly 200,000 copies were distributed.

Measuring the Turbidity of Spinal Fluids.—The far-reaching ramifications of the work carried out at the Bureau of Standards is illustrated by the fact that the bureau has been recently, at the request of the Psychiatric Institute of the State Hospitals of New York, making a study of the turbidimeter to determine its usefulness in measuring the turbidity of spinal fluids, with a view to aiding the diagnosis of mental diseases. The applicability of the turbidimeter to this purpose was demonstrated, and a representative of the bureau was thereupon designated to aid the institute in designing an improved form of the apparatus especially suitable for the work in question.

The Problem of Caring for Lepers in the United States is one that arouses interest whenever a fresh case of leprosy is discovered elsewhere than in the few states that maintain special homes for these unfortunates. As a result of an inquiry conducted by the Public Health Service in 1913 no less than 148 cases of the disease were definitely located in this country. The bulk of the patients were native born. Lepers tend to be migratory, because by changing their place of residence they can often escape for a time the isolation and ostracism due to the prevalent dread of the disease. Thus the movements of these persons constitute an interstate sanitary problem. At the last session of Congress a bill was introduced providing for the national care of lepers. Although this bill passed the House of Representatives, it was not acted upon by the Senate prior to adjournment.

National Quarantine System.—In his last annual report the surgeon general of the U. S. Public Health Service calls attention to the fact that there is no federal quarantine service at the ports of New York and Baltimore, and urges that this anomaly be corrected. In the year 1893 Congress gave sanction to the national control of quarantine by providing that whenever the proper authorities of a state should be willing to turn over its quarantine stations to the national government, the latter should have power to accept them. Under this authority, between the years 1898 and 1915 the quarantine function at 67 different places was transferred from state to national control. The transfer was made at Boston during the last fiscal year. One reason why a uniform national quarantine is desirable is the fact that the United States is a party to two international sanitary treaties, under which international quarantine regulations have been formulated, and the federal authorities should be in a position to carry out directly their obligations under these treaties.

The Botanical Status of the Rain Tree.—A recent memoir of E. D. Merrill, of the Philippine Bureau of Science, deals with the systematic position of this splendid shade tree, which has been so widely planted in tropical countries and which is the subject of an oft-repeated legend, according to which it sheds water from its leaves and branches in such abundance that its use for irrigating arid wastes has been seriously recommended! This fantastic notion has been refuted many times. (See SCIENTIFIC AMERICAN, September 16th, 1911, p. 244.) Mr. Merrill says that he "has never observed, in this species, any dripping of water from hydathodes, such as has been noted in some tropical trees." Moreover, he suggests that the common English name, rain tree, and its Spanish equivalent, *arbol de la Huria*, probably owe their origin to the fact that the "sleep," or closing of the leaflets, is a very conspicuous phenomenon at the approach of and during rains, as well as at night. In the Philippines, where it is by far the commonest shade tree found in the larger towns, the rain tree is commonly known as "acacia." In Hawaii it is called "monkey pod." Reverting to the question of its botanical affinities, Mr. Merrill adds to its already extensive synonymy by erecting to generic rank Bentham's section *Samanea*, in which the rain tree becomes *Samanea Saman*.

Aeronautics

Aviation School in China.—Vice Consul P. R. Josselyn, at Canton, China, has been informed that the Chinese government is about to open an aviation school at Canton, for which it will need several machines.

American Record for Hydroaeroplane.—What is declared to be a record endurance flight for hydroaeroplanes was established by Corporal Smith, attached to the U. S. Signal Corps Aviation School at North Island, Cal., when he recently remained in the air 8 hours and 42 minutes.

Aeroplanes for Manila.—It is reported that there will soon be shipped from the Government aviation station at San Diego, Cal., four of the new army hydroaeroplanes, which will form part of the equipment of the Second Aero Squadron at Manila. These machines are said to be the largest in the service, and can fly for about 500 miles without alighting for fuel.

Effectiveness of Aeroplane Raid.—The seventeen French aeroplanes which made a raid on Petrix, in the Strumnitza Valley, on February 1 remained over the Bulgarian town for twenty minutes and dropped 200 bombs. According to a Bulgarian *communique*, 470 men were killed in the Bulgarian camps, and the total of killed and wounded was about a thousand. In spite of a heavy fire from the enemy, all the aeroplanes returned safely to their base.

Kite Balloon for United States Navy.—An American airship constructor has lately exhibited a model of the first and only kite balloon ever constructed for the United States Government, which is now being completed for the Navy. The actual balloon will be 175 feet long, 50 feet high and 35 feet in diameter, and is of the type used by the German army. Thousands of such balloons are being used in Europe both on land and on water, and have proved of immeasurable value in directing gun fire.

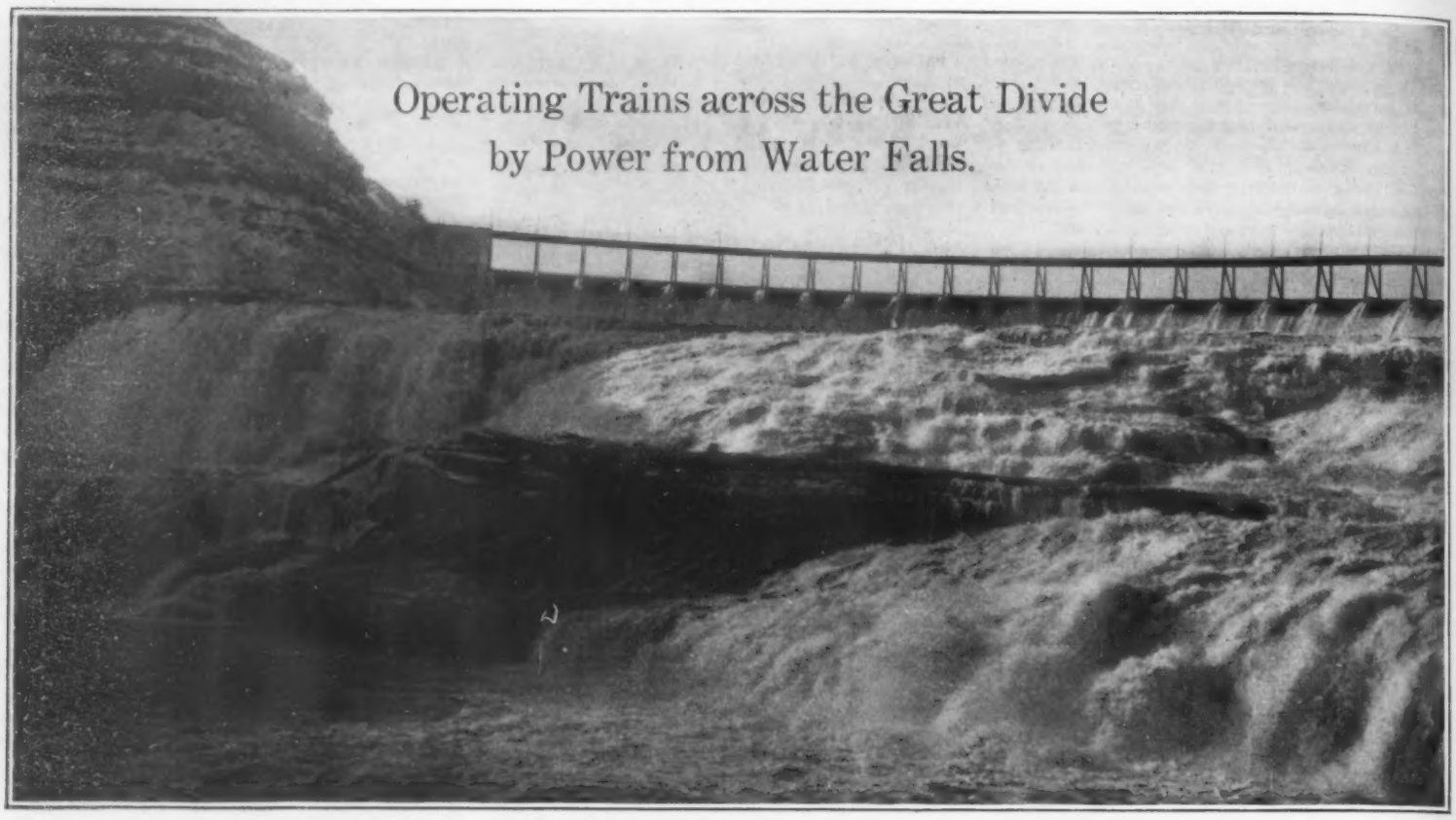
Government Building a Large Seaplane.—*The Aerial Age Weekly* states that it has knowledge of a dispatch from Washington which, on the authority of a high official, discloses the fact that there is under construction at the Washington Navy Yard a seaplane that will, in the expectations of the Government officials, be superior as a fighting unit to anything that is now flying. The Government undertook the manufacture of the seaplane because the manufacturers here were so busily engaged with rush orders for foreign governments. No details regarding the new machine are available at the present time.

Bombs in Zeppelin Raid on Paris.—According to information secured from an authentic source, it is learned that during the recent Zeppelin raid on Paris forty bombs were dropped by the aircraft, part of them incendiary and the remainder explosive. Since a number of the bombs failed to explode, the authorities have been given an opportunity of examining their construction. These ordinary steel spheres without handles; two of them weigh 136 pounds and measure 12½ inches in diameter. The shell is 5/16 inch thick and contains 46 pounds of trinitrotoluene. The third bomb weighs 224 pounds and measures 20 inches in diameter.

Advantages of Multi-Planes.—"The eliminating processes of the present war have made the monoplane almost extinct for two reasons, since the speed range need not be sacrificed," states Neil MacCoull, M.E., writing for the *Aerial Age Weekly*. "These reasons are the greater inherent structural advantages provided by the girder-like construction of the biplane, and the compactness resulting from the smaller spread required for a given area of wings—a matter of importance in landing in restricted places, and in storage and shipment. Both of these reasons must be considered when the spread of the lower wing is made less than the upper, though the advantage of a short lower wing when listing to one side while making a landing should not be overlooked."

Insurance Against Aircraft Damage.—It is reported by the United States consul stationed at Dresden that a leading insurance concern in Germany has established a department of aerial insurance. The company is issuing policies covering damage to all property, real or movable, caused by explosive bodies or other objects thrown or falling from flying machines or caused by airships or aeroplanes themselves in making voluntary or involuntary landings or parts thereof falling from them. The policies, however, make no provisions for injury to or loss of life. It is said that the numerous air raids over German cities and towns near the battlefronts, particularly in the West, have caused a demand for such policies.

Operating Trains across the Great Divide by Power from Water Falls.



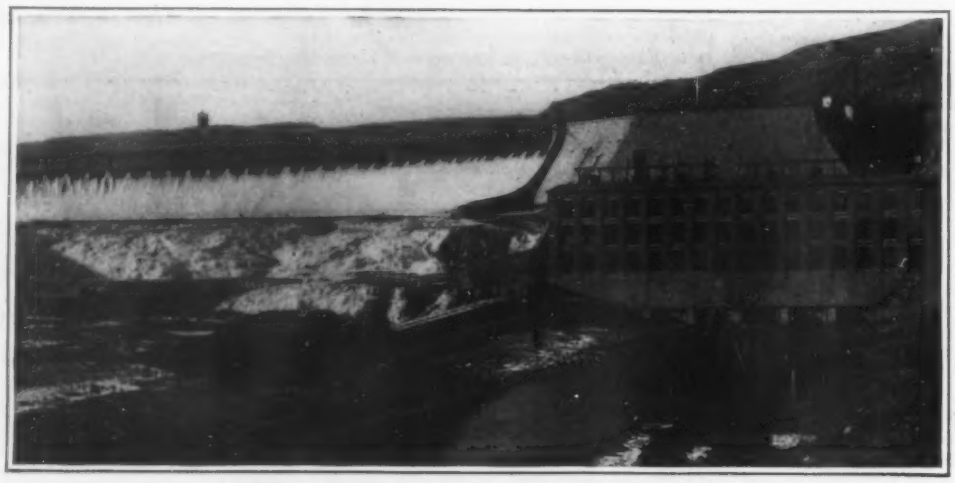
Tremendous volume of water at Rainbow Falls, the power of which in the form of electricity operates trains over mountain ranges

SLOWLY but persistently electricity is replacing steam on the leading railroads of America, and it therefore comes as no surprise that a steam railroad crossing the Great Continental Divide should adopt this efficient form of motive power, especially in view of the fact that the district served by the line is replete with rivers and waterfalls that are available to hydro-electric development.

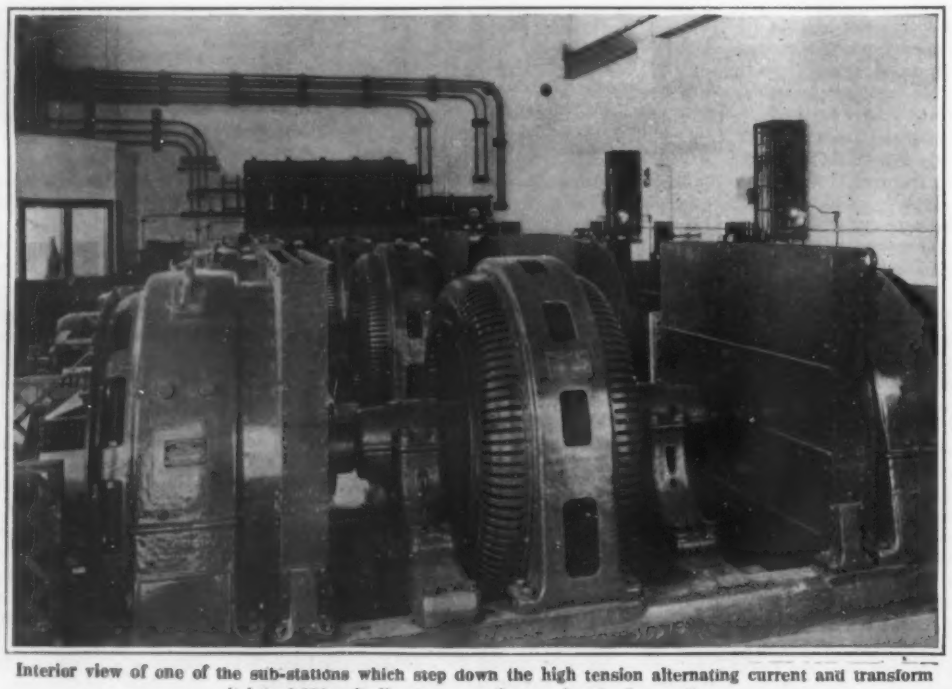
For 440 miles, or from Harlowton, Montana, to Avery, Idaho, over the Big Belt, Rocky, and Bitter Root Mountain Ranges, which form the Continental Divide, the main line of the Chicago, Milwaukee & St. Paul Railway has been electrified. Two hundred and thirty miles, from Harlowton to Deer Lodge, is now in actual operation. The cost of the entire work has been approximately twelve million dollars, and it has required three years' time to complete. The electrical energy is obtained from the mountain waterfalls along the route.

The electrification of the road is characterized by two remarkable features: first, electricity is transmitted with minimum loss over considerable distance; secondly, by producing the electrical energy from mountain waterfalls in place of coal a definite step is taken towards the conservation of the world's resources.

From Harlowton to Avery the electrified section of the road crosses the Big Belt Mountains, where at Summit an altitude of 5,788 feet is reached; the main Rockies or the Continental Divide, an altitude of 6,322 feet at Donald; the Bitter Root Mountains, an altitude of 4,200 at East Portal. Pipestone Tunnel, the half-mile bore through the backbone of the continent at Donald, is the highest elevation of the railway.



Electric power house at Rainbow Falls, which supplies the current for operating the trains over the Great Continental Divide



Interior view of one of the sub-stations which step down the high tension alternating current and transform it into 3,000 volt direct current for use by the locomotives

To give an idea of the difficulties that were confronted in this enormous undertaking, a 2 per cent grade had to be surmounted for a distance of 28.8 miles along the east approach to the Continental Divide; immediately west of the Continental Divide for a distance of 10.4 miles is a 1.66 per cent grade, and on the western slope of the Big Belt Mountains for a distance of 40 miles is a 1 per cent grade — where the track climbs 52.8 feet to the mile. These grades make steam locomotive operation difficult for long, heavily loaded freight trains, and especially so in winter time. To-day electric locomotives not only haul heavier trains more smoothly over these grades, but travel at much greater speed than when steam power was used, in all kinds of weather.

The particular and impressive feature of the Chicago, Milwaukee & St. Paul Railway electrification accomplishment is that this is the first undertaking to install and operate electric locomotives on tracks extending over several engine divisions under the most difficult traffic conditions. The various terminal and tunnel electric installations made by railways in the past were more or less necessary by reason of local conditions and limited to short distances. Purely economic reasons, together with anticipated superior operating results and greater comfort for the traveling public, was the inspiration for the extended electrification of this railroad; and it is not unlikely that the results obtained will

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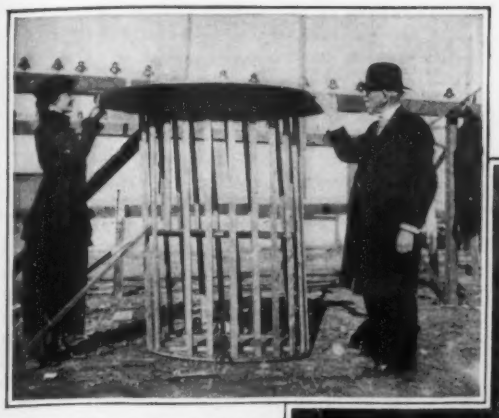
Million-Volt Commercial Frequency Transformer

By L. R. Perry



Prof. Larkin and spectator drawing 3-inch sparks from insulated disk placed under screen

Primary coil in place on laminated iron core, with the paper insulating tube about to be slipped over it. This view shows the concrete metal-lined tank to advantage

Wire basket corona insulator for confining high potential current and protecting rope insulators

THE remarkable million-volt sixty-cycle transformer which was erected at the Panama-Pacific International Exposition and used for a number of experiments and demonstrations during the closing week of that exposition, was described at length in the SCIENTIFIC AMERICAN, Vol. CXIV, No. 3, page 77. However, at the time it was not possible to present illustrations of the installation, but since then photographs have been secured and are presented in the accompanying views. Also, a number of additional facts, pertaining more particularly to the experiments, have been obtained and are embodied in the paragraphs that follow.

It will be recalled that the million-volt transformer attracted the attention of the leading electrical engineers because of the fact that it operated on a 60-cycle, 2,200-volt primary current, in contradistinction to other high tension transformers or Tesla coils built in the past to operate on high frequencies. This transformer was rated at 1,300 horse-power and built by C. H. Thordarson of Chicago, Ill.

Many months of tedious preparation and toil were spent before the final moment of the trial came. The inventor spent over $30,000 in accomplishing the construction of the transformer according to his new theories, and the San Francisco Exposition spent an added $6,000 in setting up the device for operation and demonstration in suitable quarters, this being no less than a moderate sized "Zeppelin" hangar and an acre of ground space adjoining the Palace of Machinery. On this spot the coil was brought into successful operation from the start. Many noted engineers and scientists beheld its action and its numerous phenomena and electrostatic effects; and last, but not least, thousands of spectators did likewise, scores at a time walking through and feeling the presence of an electrostatic field 50 feet square and 30 feet thick, energized by the coil at a point 100 feet distant. Many remarkable effects and experiments were indulged in by the crowds, this being the first time in history that such an opportunity had been offered on so large a scale.

At the left: Four-foot secondary of the million-volt transformer. At the right: 2,000-pound paper insulating tube interposed between the primary and secondary windings

It had been surmised by the inventor that a new and unexplored field of research would be opened up by the existence of such an electrostatic field, and it is said that the results have been highly gratifying. Probably one of the greatest discoveries thus far has been that power can at last be generated, safeguarded and transmitted on a scale never before attempted. For years leading manufacturers of America and Europe have endeavored to construct high potential transformers to operate on low frequency—60 cycles or lower, and failures have been innumerable until the success of the Thordarson transformer. Furthermore, it is now apparent that this type of transformer is destined to work radical changes in the scientific and industrial worlds: large or small

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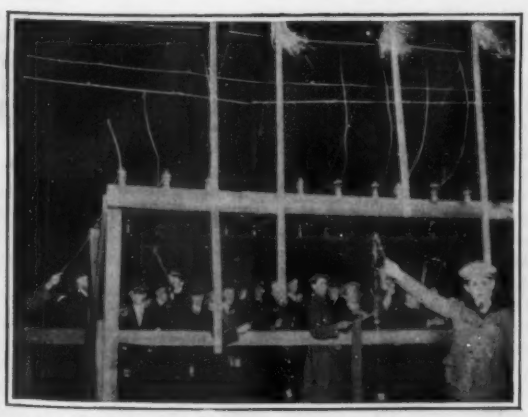
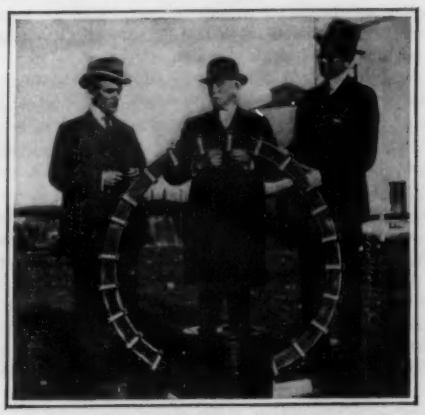


Night crowd enjoying public demonstrations and opportunity to experiment



A section of the transformer secondary as compared to secondary of 20 k.w. transformer

Special building erected to house the huge transformer used in the tests

Industrial Preparedness for Peace

V. The Human Side of Salesmanship

By Miner Chipman

THE first World's Salesmanship Congress will be held in the city of Detroit in July, 1916. It is hoped that this great convention, fathered by Hugh Chalmers, Norval A. Hawkins, John Wanamaker, and others, will stimulate the entire country to a realization of our trade opportunities. Rapid strides are being made in the efficiency of salesmanship. We have much to learn in the problem of selling to the consumers of foreign lands. We have the goods, we have the men, we have the money; all we need is competent guidance, and a proper recognition of the human element.

Sales Lost Through Lack of Postage

Commerce Report, Number 50, for March 1st, 1916, has the following item relating to solicitation of business in the island of Jamaica:

"A letter received by the Chamber of Commerce of the State of New York from an American business representative in Kingston, Jamaica, emphasizes once more the need of correcting serious mistakes that are made by firms in the United States, in communications sent to the island. Hundreds of letters soliciting trade in this British community are in the Spanish language, while carelessness is shown also in the lack of attention to postal requirements. The postage to Jamaica from the United States is five cents, but the writer says: 'Letters come invariably with two-cent stamps, making the addressee pay six cents surcharge.'

"Complaint is made, also, that American businessmen do not take the time to write a few pleasant things in their letters, and thus fail to gain the attention of persons in foreign countries."

With the one exception, the office boy's frequent attendance at the funeral of his grandmother, there is nothing more annoying to a businessman than the payment of "Postage Due." It is a manifest reflection upon the efficiency and foresight of the sender. The cause of this inefficiency is found in the delegation of responsibility. A firm desires to extend its trade into South America. The head of the house delegates the responsibility for trade extension to a sales manager, who in turn delegates the responsibility to an ambitious clerk, who finally delegates the seemingly unimportant matter of postal rates to a $6.00 a week office boy.

Standard Practice Instructions

The Larkin Company of Buffalo provides each employee with written Standard Practice Instructions covering the functions and operations for which he or she is responsible. Responsibility is delegated, but with staff plans, and staff instructions. You may be assured that the Larkin Company would not mail letters to Jamaica with insufficient postage attached. Staff officials in its organization make it their business to see that such errors do not occur. A large manufacturer of writing papers has employed a man to do missionary work among the printers of the country. He is sent out to obtain first-hand knowledge of the use and abuse of fine writing papers, and teach the printer new methods for selling and utilizing the product of the paper maker. The operators of the American Telephone and Telegraph Company are given several weeks' instruction in the multitude of "little things" that make for efficiency in telephone service. It is not enough to look at things in a *big way*, we must look at the little details in a big way, for our success or failure will be determined by our control of these seemingly unimportant matters.

Getting First-Hand Knowledge

The businessman who really desires to extend his trade should make staff studies of the field he intends to cover. It may be unnecessary for him to go further than the public library. If he is wise he will get in touch with the Bureau of Foreign and Domestic Commerce. He may correspond with the leading universities, many of which maintain specially trained staffs dealing exclusively with these problems. The letter quoted above calls attention to another important matter, viz.: the neglect to put a little human touch into a communication. Many salesmen imagine that curtness is efficiency. Sometime ago a salesman covering a large territory in South America said to me: "I usually spend two or three months getting acquainted with my prospects. I never mention business. We meet in a cafe, or have dinner together. We manage to get very well acquainted. Suddenly I get the business. A salesman simply cannot force those fellows down there—a large percentage of the business is done because they like you, other things being equal." The importance of the human equation in business may be discovered all about us. I believe the most valuable asset in an employee is the ability to be effective and calm, forceful and courteous. One day last week I had an appointment with Hon. Elbert H. Gary, Chairman of the Board of the United States Steel Corporation. I arrived at the office in the Empire Building to the minute, and was met by a clean-cut, healthy looking gentleman, who introduced himself as Secretary to Mr. Gary. His name is George K. Leet, and he's a wonder. We visited for about ten minutes. He was so courteous, so interested in me and my work, that when I left the office I did not realize that I had not met Judge Gary until I stepped out on Broadway. I then realized that efficient Mr. Leet had casually advised me that the Judge had another pressing engagement and would be obliged if I would cancel my appointment. He was a masked battery. Hidden under cover of soft green foliage were the machine guns of efficiency. I can easily realize why he holds one of the most important and difficult secretarial positions in the country. That type of ability never goes begging for employment. The world needs just that kind of men. The markets of the world are open to salesmen who have the charm and courtesy of a gentleman and the holding power of first line trenches.

Service:—Giving the Customer What He Wants

Time and time again American manufacturers have been reminded that it is necessary to fit the product to the customer in seeking trade in South America. The Germans know how to do this. The sale may depend upon the design of the wrapper, the size of the container, or some other seemingly unimportant detail. Unimportant in the eye of the manufacturer, all important in the eye of the customer. John Ballentine was the merchant prince of the small town where I spent my boyhood. He represented a type of the merchants of the old school. John was his own buyer, and what he purchased the people *had to buy*. He defined service as selling the people *what he had*. In the pioneer days when wants were few, and style was confined to the cut of a kitchen apron, this type of merchandising would pass without challenge. Occasionally an upstart of a customer, who had, perhaps, visited Detroit or Chicago, would ask for something not in stock. John would invariably say: "Why I do not keep it; I could not sell it if I had it." The inevitable march of time brought a growing demand for style and variety. John could not change. He failed and never knew why. Men who fail for this reason seldom know why. The merchandising problems of the world are all typified in the small town merchant. When John Clark started an exclusive grocery store. The people laughed. The merchants laughed. From the time when a Huron Indian stuck his tomahawk into the pine tree at the crossing of the state roads and called it "Bad Axe," it was considered necessary for a merchant to carry everything in stock from corn starch to red flannel underwear. John Clark succeeded. He more than succeeded. He is now the proprietor of a large and prospering wholesale grocery. He adopted new and radical policies. He not only offered for sale "What the people wanted," but he educated the people to "wants" they had never known before. He put in fancy lines of groceries, with purple and gold labels, and got fancy prices. It became a matter of social prestige to serve French peas for dinner, eat grape-fruit for breakfast. He made merchandising a social institution. That is the real secret of trade expansion. The merchant must have a community interest, he must not only supply the existing wants, but he must educate his customers to other wants having a profitable significance. Fame and fortune are relative terms: the name of Altman in New York, has the same relative potential value as John Clark in my old home town. Both gained their reputations through efficient *service*.

Merchandising Policy

In my opinion, the store of William Filene's Sons Company, in the city of Boston, is the most scientifically operated merchandising organization in the world. Ten years ago some of their advanced notions were scoffed at by merchants throughout the country. The policies they established were first laughed at, then studied, then adopted by other stores throughout the country. The operation and administration of the Filene store would make a good subject for study by any man desiring to conquer foreign fields of merchandising. Fundamental in the Filene business is *Policy*. Nothing is left to guesswork. Planning is the beginning of everything, is the source of all action, and so well planned that success is usually assured. The Filenes have never closed their doors to suggestion from the outside. The development of scientific management in the Midvale Steel Company's plant by Frederick W. Taylor was immediately reflected in new methods and new systems in the Filene store. The planning and despatching evolved in the shops of the Santa Fé Railroad under the direction of Mr. Harrington Emerson had its effect upon the management of the Filene store. They have what is called an Automatic Bargain Basement. It is a novel institution. In this Bargain Basement merchandise is either sold or *given away*. If an article is placed on sale at $1.00, it remains at this price for twelve selling days, and if unsold the price automatically drops to 75 cents, at the end of another six days it drops to 50 cents, in another six days to 25 cents, and then if unsold at the expiration of another six days it is *given away*. This department is the most high tension, rapid-fire merchandising scheme in the country. It involves some of the most important and fundamental principles in modern merchandising. The automatic price reduction of the Filene Bargain Basement is thoroughly scientific. Few merchants would have the nerve to initiate such a plan, but the Filenes not only have the nerve, but have the ability to make it a tremendously profitable undertaking. It is interesting to know that in this Bargain Basement the Filenes do a business equal to half the volume of a number of the large stores on Fifth Avenue. The secret of their success lies in their policies, and their exhaustive planning of detail. The name of Filene is synonymous to Planning and Efficiency.

Selling Father Through the Baby

One of the most successful insurance salesmen in the country has achieved his position through recognition of the human element in business. His first step is to make friends. He aims to discover their hobby; he endeavors to find the soft spot in their hearts, and then gently, very gently, plays upon it. He sold a $25,000 policy to a friend of mine through a carefully worked out heart-throb campaign, the center of which was my friend's nine-months-old baby. He first sent a number of clever little poems, linking daddy and baby and life together. He then developed the theme into the deeper meaning of life, its duties and its struggles. He constructed a career for the baby, sent him to school and then to college. It required money. Before the youngster had reached the age of ten months the father had insured his life for $25,000 to see the plan through. This life insurance salesman knows the power and force of ideals. He plays on these forces. He not only becomes a successful salesman, but leaves behind him a score of friends and a long list of satisfied customers.

I once had the pleasure of meeting a book agent who made $10,000 a year through an appeal to the human equation. His scheme was crooked, but it illustrates the force of human appeal. He dressed like a young college lad, and sought out in every town and city the college graduates. He then canvassed them with a plea for assistance to put him through the last year of his college career. It worked. By appealing to the Rah! Rah! days of the Alma Mater he sold his wares. He was not selling books, he was selling sentiment.

Expansion of Trade Into Foreign Markets

The secret of merchandizing success lies in *Organization*. Not a mechanical organization, but the building of a great human mechanism. Brains in the Staff and Brains in the Line—there are no substitutes. Back of the plans, back of the merchandise, we must have real men. *Men* who know and understand other men; *Men* with a touch of sentiment. The mere accumulation of cold facts, the establishing of agencies, the sending of samples, the bidding for trade is insufficient. We must have more than all these. We must have men who can analyze the inner sentiments and aspirations of the foreign peoples, fit their policies to the stranger peoples, and aid them in the attainment of their national and racial ideals.

A study of markets is a study of people. Do not depend upon the first edition of Chambers' Encyclopedia, the Explorations of Humboldt, or Prescott's Conquest of Peru for your informaiton. Get posted—right up to the minute, and do not forget that you are selling men not merchandise.

From the Editor's Mail Bag

A. B. FARQUHAR, President, A. B. Farquhar Co., Ltd., of York, Pa., Director of the Chamber of Commerce of the United States:

"As the world never was in such a condition before in all its history, it would be impossible to prophesy either when the war will end or the conditions in

(*Concluded on page* 308)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Present Status of the North Pole Question

To the Editor of the SCIENTIFIC AMERICAN:

On January 13th, 1916, the Hon. Henry T. Helgesen, of North Dakota, made a speech on the floor of the House of Representatives (published in the *Congressional Record* of same date, pp. 1092-1099), summing up what he has accomplished by much hard work for over a year. Briefly the results of his labors are that the Navy Department (Hydrographic Office) and the Coast and Geodetic Survey have been obliged to repudiate and take off from Government charts all of Admiral Peary's reported discoveries, namely: "Peary Channel" (thereby denying Peary's claim to the insularity of Greenland), "East Greenland Sea," "Crocker Land," "Jessup Land," and the soundings claimed to have been made by Peary in 1909, when he asserts that he reached the North Pole. This ends finally any controversy about the discovery of the North Pole, for Peary's claims are now officially thrown out.

Mr. Helgesen does not, however, touch in any wise on the claims of Dr. Cook. These now stand at present as follows: Cook's claims to have made the first ascent of Mount McKinley have been verified unintentionally and unwillingly by the climbers who followed him up the mountain. Cook's discovery of the non-existence of Crocker Land has been verified by MacMillan. Cook's three other Arctic discoveries, Bradley Land, Cook-Land-Ice, and the endless fields of purple snows at the North Pole, rest now for proof entirely on Cook's own statements and astronomical observations: corroborative geographical evidence can no longer be drawn from Peary's statements since these are now officially declared invalid.

The verification or disproof of Cook's discoveries geographically, however, is only a question of time. Besides the unknown Arctic, there is almost nothing, except part of Antarctica, left in the world to explore. Bradley Land has already appealed to one explorer and the time is perhaps not so far distant when a new expedition will start for its shores. Nevertheless, the fact that Peary was deceived by a mirage into believing that there was a land which he called Crocker Land shows that there is a possibility that Cook also was deceived by a mirage into believing that there is a land which he called Bradley Land. And the further consequence of this is that while the refinding of Bradley Land would absolutely verify Cook, the finding that it was non-existent would not of itself discredit him. And if it should prove to be non-existent, there would still remain Cook-Land-Ice in 87 deg.-88 deg. N., and the endless fields of purple snows beyond 88 deg. N., by which to verify Cook's discovery of the North Pole.

In saying that Bradley Land has already appealed to one explorer, I must tell briefly of an attempt to reach it which was made in 1914 and 1915 by Messrs. Rudolph Franke and Arthur Haack and which failed partly on account of unusual ice conditions. They sailed from Quebec on July 4th, 1914, on the S. S. *Guide*, with the Canadian Arctic explorer and fur trader, Captain J. Bernier, who agreed to leave them at the entrance of Jones Sound. On account of bad ice, they were unable to reach either Etah or Jones Sound. After a summer spent in fighting the ice floes of Baffin Bay, they were finally nipped just south of the entrance of Lancaster Sound and forced to winter there. While out hunting one day, a great blizzard came on in which Mr. Haack was frozen to death. This ended Mr. Franke's hopes of trying to reach Bradley Land and he returned to Quebec with Captain Bernier to find himself a prisoner of war, a unique ending to an Arctic voyage of exploration.

Philadelphia, Penn. EDWIN SWIFT BALCH.

[Editorial comment on this letter appears on p. 295. —ED.]

Battery vs. Magneto Ignition

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of Jan. 1st, 1916, on page 11 you refer to "The Trend Toward Battery Current Ignition." The statement you make that "with the universal adoption of electric starting and lighting systems has come a marked diminution in the number of firms using high-tension magneto ignition," requires further explanation, as it does not do justice to the magneto.

While it may be true that the number of makers using battery igniton has increased, it is by no means true that the number of cars so equipped has increased. I call your attention to the fact that out of 176 cars listed in the show issue of *Motor Age* of Dec. 30th, 62 of these, or 35 per cent, were magneto equipped. By far the largest number of cars are actually magneto equipped. High priced cars are practically all magneto equipped and nearly all foreign made cars use magneto equipment. Battery ignition has practically nothing to recommend it except cheapness. It is true that for a while the manufacturers of eight and twelve cylinder engines had difficulty in securing suitable magnetos, but this has recently been eliminated. Both eight and twelve cylinder magnetos of high efficiency are now procurable and a standard product with one of the largest American manufacturers of magnetos.

There are many objections to making the ignition on an automobile dependent upon the starting and lighting battery. It is seldom that this battery is at its maximum efficiency, not because of anything inherently wrong with the charging outfit provided, but usually due to a lack of care on the part of the average user. It may be true that the varying conditions of a battery does not affect the ignition, this is claimed by some makers of battery ignition, but there is one thing certain that a car with battery ignition will not run when the battery is dead and such cases are only too frequent. The complication of battery ignition, the timer mechanism often being a part of the lighting and starting dynamo, is well known, and while many attempts have been made to remove this complication, it still exists to a large extent. The many wires and connections sometimes requiring thermostatic switches for cutting off the current in case the ignition switch is left "on" with the engine at rest, and the fact that these systems are but slightly understood by the average repair man, all tend to make the battery ignition system secondary in efficiency and desirability from a standpoint of the average car user. The original high tension magneto was rather complicated and difficult to repair. This does not hold good with the modern types wherein the windings are removable, the breaker points stationary, and all parts easily accessible for inspection and repair by anybody. The fact that magnetos are used on practically all high grade cars, all aeroplanes, and exclusively for racing, should be sufficient evidence that they are considered by those who know to be far superior to battery ignition in any form; the main reason for the use of other forms of equipment is cheapness.

Sumter, S. C. H. R. VAN DEVENTER.

Pistol vs. Bayonet

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Crossman's timely and interesting article on the bayonet causes the question to arise: whether in many cases, weapons specially adapted to certain conditions, weapons which might be transported in motor trucks, and served out on occasion to troops trained in their application, would not greatly increase the effectiveness of our Army.

If bewildering speed was an essential in the invasion of Belgium and France, it would be of still greater importance in a campaign conducted with the objective of conquering a considerable area in the United States. It seems unlikely that the initial expeditionary force would include sufficient heavy ordnance for trench blasting operations on an extensive scale; as its disembarkation and transport, together with millions of rounds of ammunition, would occasion serious delay. It seems probable that the invading infantry would be pushed forward to the limit of endurance, and then be dashed against our thin defensive line in a terrific drive. If this premise be correct what arm in the hands of intrenched defenders, or reserves, will be most effective upon the mass formation of the enemy, when rifles are empty, and the time too short to insert another clip?

At this juncture I believe 2,000 riot guns per mile would smother 20,000 bayonets. I once witnessed a test of one of these weapons, a short barrel cylinder bore automatic shot gun, capable of delivering 50 to 60 buck shot in an almost continuous cone of fire. It would be a tremendously effective weapon for close combat, and spare magazine cylinders could be devised, for quick loading. In the hands of cavalry trained to use it from the saddle it would be far superior to saber or lance in a melee.

Now as to the application of another weapon, let us assume that our forces are on the offensive, they are within a few feet of bayonet contact with their opponents, they are about to fight with a general purpose weapon—the bayonet—which, as Mr. Crossman aptly states, is inferior to the weapons of antiquity; under these conditions, both sides being armed with weapons of equal inefficiency, if an attacker succeeds in "putting out" a defender, he has done about all that may be reasonably expected of him. Furthermore we are credibly informed that among trench labyrinths, entanglements, etc., the bayonet, because of its unwieldiness, is often discarded for the knife or bludgeon, thereby retrograding to caveman efficiency.

If the individual infantryman in the attack, carried his rifle slung on his back and was provided with two heavy calibre automatic pistols, and had been trained in their use—a two-handed gun fighter—we might reasonably expect him to place five or six of his opponents hors de combat, as many a frontiersman could have done with his old forty-five Colts.

Katonah, N. Y. GEORGE HALL.

Trieste

To the Editor of the SCIENTIFIC AMERICAN:

As a constant reader of your highly esteemed publication and one who, through long years, has come to value the scientific importance of the articles published in the SCIENTIFIC AMERICAN, I have been following with a keen interest the series of letters written by your military expert in connection with the Strategic Moves of the War in Europe.

And while all along sincerely appreciating the earnest endeavor on the part of your war correspondent to do full justice to both sides, it was not without some regret that in reading through his letter of the 24th November (which has only now come to hand) I came upon a statement made perhaps inadvertently but which, as not being in accordance with the strict historical facts, I see myself prompted to correct so as to prevent any misconception on the part of your American readers as to the motives which have led Italy to enlist on the side of the Entente.

For if, with reference to the city of Trieste, your military expert at the conclusion of his letter, holds out the hope that "the Italians will . . . bring again under Italian rule their citizens who for years have been looking forward to the day when they should again be living under the flag of King Humbert (sic!) . . ." he appears to labor under the impression as though that portion of the Austrian Empire originally was Italian territory and that all the Italians are now driving at is merely to get back their own. Now any such statement made in good earnest would be a flagrant contortion of historical truth, and I must ask you to allow me to point out that Trieste never did form a portion of the Kingdom of Italy, as a simple reference to any standard encyclopædia will immediately corroborate.

Trieste (the Roman "Tergeste") was originally settled by various Latin colonists and from having formed a portion of the vast Roman Empire fell, in the course of time, under the sway of the Habsburgs, and has continued to constitute an indivisible portion of the Habsburg Monarchy from the year 1382 onwards to this present hour, with the sole exception of two short intervals; namely, from 1797 to 1805 and from 1809 to 1814, when it was under *French* rule. But it *never was* under Italian predominance, and, please God, it *never shall* be.

Your war correspondent being a military gentleman and therefore not easily daunted, even by facts, I apprehend that he may come forward and tell me that *prior* to 1382 Trieste was held by the Venetians. This is, of course, not denied, but to my mind this would as little justify any present claims made by Italy, as if Spain were suddenly to reclaim Florida or the Netherlands, Manhattan Island.

It is also true that the majority of the inhabitants of Trieste, as of all the Austrian Coast Land, consider the Italian language as their mother-tongue: this, however, has absolutely no bearing, upon the question, but merely confirms, what I have already pointed out, that this section of Europe was settled by colonists coming from the opposite shores of the Adriatic and this long before the present Kingdom of Italy was ever dreamt of. In fact, if similarity of speech were to decide the point under discussion, then with equal justice France might to-day lay claim to the Province of Quebec and the Kaiser be entitled to call on Uncle Sam to immediately yield up—Milwaukee to the German Empire.

I shall be glad if you will give publicity to this letter for the sake of historical truth, and thanking you in anticipation for any courtesy shown, I am,

ARTHUR LINDENSTEAD.

1. Karlsplatz 3, Vienna, Austria.

Paper as Fuel

To the Editor of the SCIENTIFIC AMERICAN:

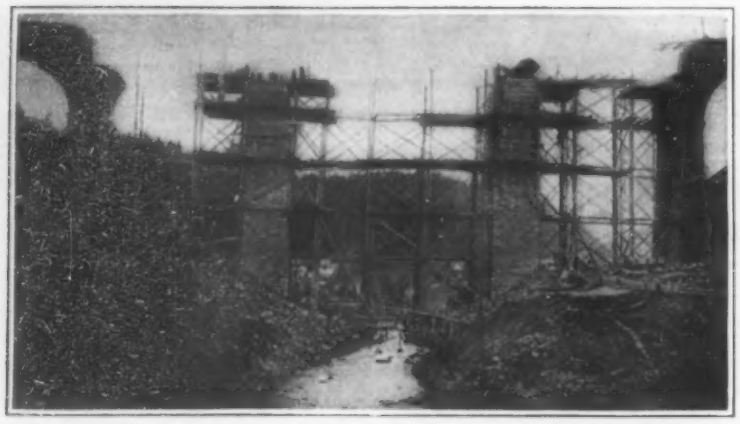
I notice in a paragraph on page 10 of the January 22d issue some news of the paper fuel now used in Italy. It is somewhat incorrect and vague. To begin with, the rolls of newspapers, after being cut into small cylinders, are boiled for about 10 minutes in a solution of paraffin and naphtha which gives them their burning qualities.

They are only used by soldiers which have been on duty (sentinel, etc.), and have not been able to partake of their food with the rest, as the food reaches the trenches in a hot state and remains so for quite a while as it is carried in boxes similar to the fireless cookers.

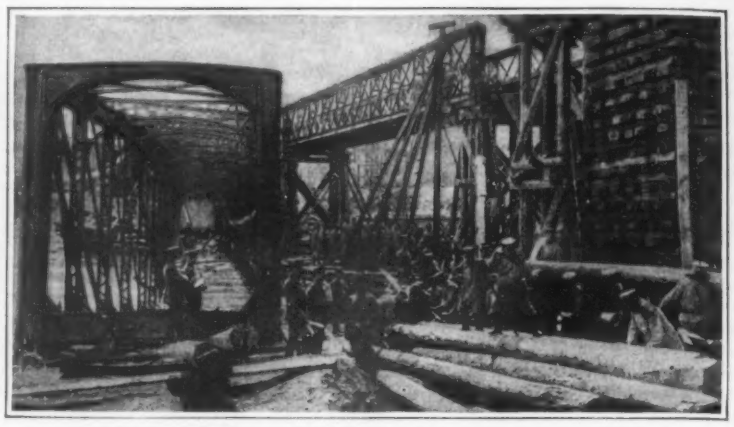
The soldiers do not care for this paper fuel, as it makes a very sooty flame, and never use it in camp (that is, when they are enjoying their 15-day rest) because they don't need to then. The many committees that sprang up for the manufacturing of these "Scaldaranel," as they are called, are little by little quitting, having seen the little utility of their work.

CHARLES I. WHARTON.

S. Teresa a Chiaia 41, Naples, Italy.



This bridge 591 feet long and 108 feet high was restored in a very short time



One of the big tasks negotiated by the German railroad organizations

German Military Railroad Organizations at Work

GENERAL Leonard Wood and other eminent officers of the United States Army have strongly urged of late the need of mobilizing the railroads of the country. Apart from munitions, facility of transportation has more than once decided the struggle upon the battlefields of war-racked Europe, and the railroad played the prime part in these strategic shifts of front. The following article is an abridgment of information given to the German public by the authorities of the railroad division of the army. It covers only the first nine months of the struggle, but it gives us an excellent idea of the basic organization, with its workings, which has contributed so much to Teuton successes.—EDITOR.

IN order to appreciate what was the nature of the task that suddenly confronted the German railroads at the beginning of August, 1914, it is necessary to recall general conditions at the time. The holiday season was at its height and the traffic incident to it was heavy. Great volumes of freight were in movement, besides; and in every military district the big practice grounds were occupied by troops engaged in annual maneuvers. When war was declared on the 2nd of August, the citizen population away from home made a general rush to the railways in order to escape delays that might be expected to follow when the tremendous tide of soldiers and equipment set toward the fronts. Thousands of others rushed by the same routes to distant points to reach sons, brothers and husbands at the practice camps before they should be off to the battlefield.

Some of the divisions had to be sent to the western frontier through sections alive with manifold industries. Thousands of long military trains were needed. In order to prevent hopeless congestion while these trains were en route all of the stations along the lines had to be cleared of a staggering number of loaded and empty freight cars. Simultaneously with the advancement of these troops an equally heavy movement in railroad equipment was begun. Hundreds and hundreds of freight cars and coaches and scores and scores of locomotives made up in seemingly endless trains were pushed along to those sections of Germany where, according to careful calculation, the rolling stock would be most needed.

Then began the real mobilization. Millions of reservists were carried to their appointed rendezvous; and supplies and accoutrements for the troops were brought up together with the wartime armament for the fortifications nearest the enemy. From those sections of Germany where horse raising is especially followed, trainload after trainload of these animals were taken to the places where they were required in order to bring the troops up to a wartime footing according to prearrangement. Likewise, immense quantities of livestock were similarly transported to the army canning factories; and from the very outset of this wholesale stimulation of rail service the mining districts began pouring out vast quantities of coal which were borne to the naval bases.

A few hours after mobilization had been ordered, the first troop trains were on their way to the fronts; and day by day this movement increased until the armies stood ready for service and magazines and other supply stations reached far rearward, according to previous plans, for the purpose of supporting the troops under all conditions. This efficiency was the immediate result of the work done in time of peace by the railroad division of the General Staff and its various associate organizations. Plainly this readiness was born of intimate coördination with many other authorities and especially with those having normally to do with the administration of the railways. The schooling in time of peace of the military railroaders proved its great worth when the hour for conflict arrived.

A tunnel section 150 feet long being cleared for service by the Germans after destruction by the French

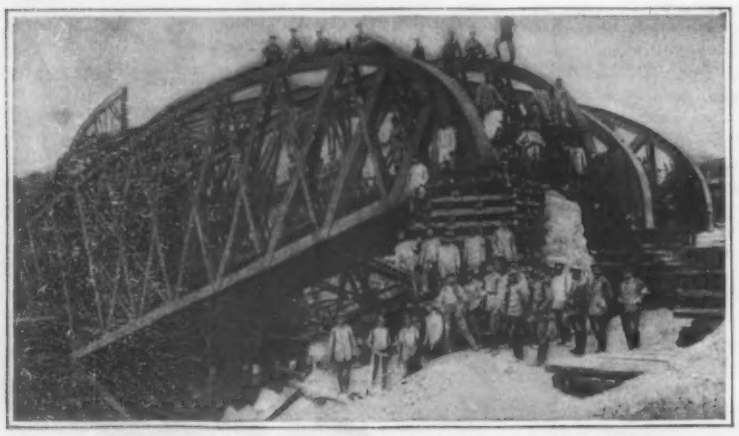
The skill of the officers in charge of the "railroad marching columns" undoubtedly contributed very largely to the German successes upon both the East and the West fronts, but it was due to them mainly that the Kaiser's forces proved victorious in their remarkable drive through Galicia. The flexibility of the railroad marching columns depends, in the first place, upon a well-developed network of lines, and then upon a perfect understanding of the physical characteristics of those routes bred of a careful survey of them by the General Staff in times of peace.

With the armies delivered at the fronts and the troops ready to advance, then the Chief of the Railway Division and his staff went into the field. With the beginning of mobilization, the relation of the military railroad authorities to the regular railroad managements changed completely, and the peacetime organizations were at once made subject to the orders of the Chief of the Railway Division, who had the power to continue, discontinue and regulate in every way the workings of the roads.

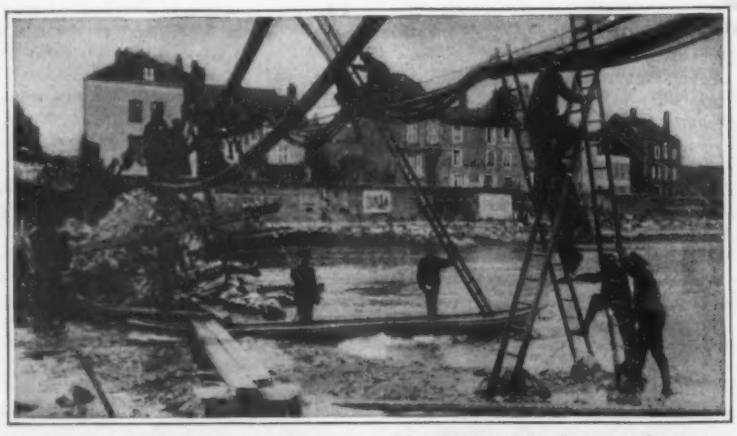
The moment the German troops entered upon enemy territory the problems of the "railroaders" became many and various. The retreating foes dynamited bridges, blocked tunnels, destroyed rolling stock that could not be moved, and, as far as possible, tore up the roadbeds and effectually damaged the rails. It was of course necessary that the invading Germans should advance rapidly, and it was equally vital that the railroads should be restored and pushed along quickly behind the troops. In anticipation of just these tasks, two Military Railroad Organizations were detailed at the time of mobilization for this important work.

Organization No. 1 was in readiness at Aix-la-Chapelle for the advance into Belgium, and was the first in the field and among the foremost of the invading troops. Aside from minor damages, such as torn up rails, over-turned locomotives and cars blocking the route, they found 13 bridges that had been dynamited and a tunnel choked up by running into it at full speed a number of engines purposely collided. Telegraph and telephone wires had been torn down and the operative plants of railway stations put effectually out of commission.

As in every other field of their service, the railroaders toiled ceaselessly. It was not long before they achieved



A slow and difficult restoration task for the German "railroaders"



The German "railroaders" restoring power cables destroyed by the retreating enemy

all necessary repairs and had the lines temporarily fit and, later, put them in first-class shape. Some idea of the speed with which these things were done on the western front can be gathered from this official statement of operations: "On September 1st, 1914, Military Railroad Organization No. I moved into Brussels, and at the end of October it pushed on through to Lille. Newly-formed organizations then took over the management of the restored roads and stations. On the 20th of August, 1914, Military Railroad Organization No. II was stationed at Ulflingen. On the 25th of August it had advanced as far as Libramont, and by the 4th of September it reached Sedan." As Organization No. II moved on it was likewise supplanted by newly formed railroad working forces as far as Luxembourg. The western front finally reached such proportions that Military Railroad Organization No. III was created and its headquarters were established at Charleroi.

The railroad lines immediately behind the fronts are operated by the railroad troops, and linking up to these sections from the rear the service is maintained by the regular personnel of the German railroad system. This illustrates just how the peacetime and the wartime organizations are coördinated.

Following the first few months of the war, during which the railroaders were called upon principally to restore and maintain established rail routes, their work became that largely of building entirely new lines or in double tracking and otherwise amplifying existing roads. Where the German tracks stopped at the frontier it was necessary to extend them into the enemy country as far as military exigencies demanded. This imposed a great many difficult undertakings. During the winter when the ground was miry, highways dreadfully cut up, vehicular traffic wellnigh prohibitive, and the tracks of the rail lines in a bad condition, an extensive network of tramways or field spurs was built right up to the firing lines in order to bring forward ample supplies of munitions and provisions.

In place of temporary bridges, permanent ones had to be erected in course of time so as to bring up the service to a high state of efficiency and to insure safety for the heavy traffic. Again, in this work, the railroad troops did their part in the theaters of war, while private firms in the Fatherland were called upon to do all the necessary engineering work of this sort in the rear. Since the beginning of hostilities, 104 big bridges have been constructed, 8 tunnels have been rebuilt, and 14 important main railroad lines have been restored to service. Besides these things, 160 railroad stations have been enlarged by adding to their yard trackage and their facilities for loading and unloading freight. Further, numerous sidings, able to accommodate the longest of military trains, and many branches, connecting main lines, have been laid.

The following table gives at a glance a comprehensive idea of the German military railway service in enemy territory and includes as well the constructional work done up to April of 1915. These figures to not include the Russian roads contiguous to East and West Prussia and east of the Vistula.

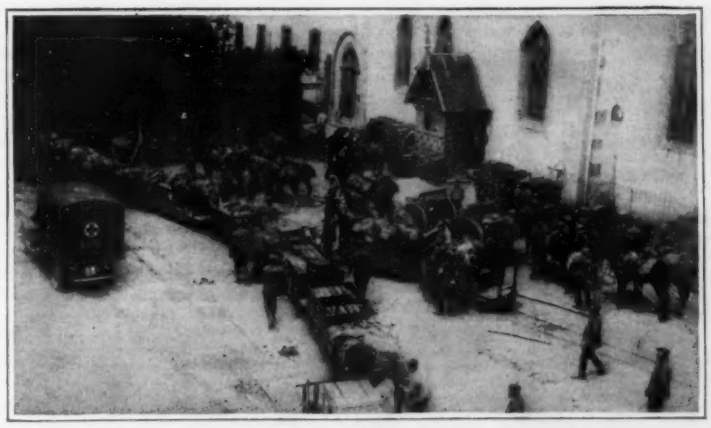
LENGTH OF RAIL ROUTES, IN KILOMETERS

	Single Track.	Double Track.	Total.
In military service.	3,000	4,100	7,100
Leased	450	150	600
Not in use	550	20	570
Not restored	90	20	110
Building	400	15	415
	4,490	4,305	8,795

SERVICE ORGANIZATIONS AND PLANTS

Administrative departments	75
Mechanical departments	25
Shop departments	10
Stations in service	1,200
Workshops	70
Gas plants	5
Electric power houses	350

The biggest wooden railroad bridge constructed in northern France by the German Pioneer Corps



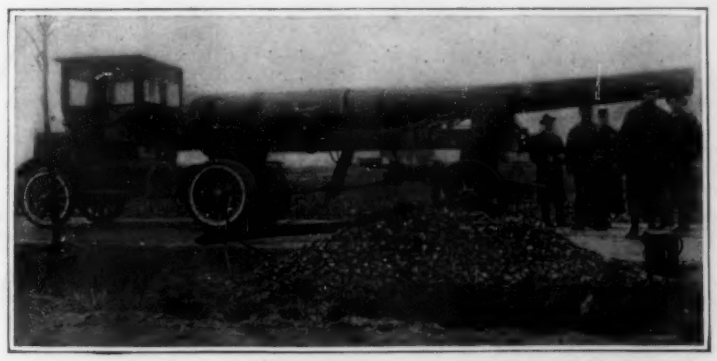
Munitions being moved to the firing line by means of tramways built by the German railroad troops

WELFARE WORK

Disinfecting plants	20
Bath houses	130
Military hospitals for railroad personnel	35
Red Cross rest and first-aid stations	30
Lodging houses for transient personnel	135
Homes for railroaders	5

PERFORMANCE OF ROLLING STOCK

Train kilometers	3,000,000



American-built tractor and trailer which served to transport a 20-ton gun 11 miles in an hour and a half

Twenty-ton gun transported on a two-wheeled trailer hauled by a four-wheeled American-built tractor

These activities are entirely apart from the public passenger and freight service, which was maintained all the while.

This recital shows the part advance organization and well-planned coördination have played in the mobilization of Germany's railroads for military service. The lesson for us is a plain one.

Rapid Transportation of a 20-ton Gun by Motor Truck

IT is extremely doubtful whether many of us realize the stupendous tasks which could be entrusted to the gasoline motor in any present-day campaign of preparedness. The photographic evidence offered in the accompanying illustrations is of unusual interest as recording hauling feats already performed by an American-made vehicle of a comparatively new, but unusually efficient, type.

For obvious reasons it is not possible to divulge particulars of the gun-hauling feat which is here pictured. However, it is possible to state that the gun is approximately 26 feet long and weighs over 20 tons. The vehicle supporting the forward end of the gun and serving as the propelling power for the huge load, is a four-wheeled, American-built gasoline tractor.

The 20-ton gun was hauled by the powerful tractor over 11 miles of poor roads in an hour and a half. The significance of this feat may be judged by the fact that with ordinary means it formerly took a day and a half to do the work.

The Current Supplement

AN interesting article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT is *The Woods of Hawaii*, which tells something about the different varieties of trees growing in the islands, and the qualities of the woods they produce. It is attractively illustrated. *The Physician and the Weather Bureau* gives some useful information concerning the effects of weather conditions on health, and the advantages the physician may derive from the information furnished in the weather reports. *The World's Largest Electric Kitchen* is an account, with several illustrations, of an elaborate establishment maintained by a large manufacturing company in Germany. *Problems in Photo-Chemistry* treats of several problems of light that will interest the scientific photographer. *Calculations for Ship's Forms* treats of the facts that model experiments show in regard to resistance, propulsion and the rolling of ships. *Protection of Life and Property Against Lightning* gives much information that is of wide value. The paper on *The Structure of the Earth* is concluded.

There is some interesting correspondence in relation to the illustrations of the model restorations by Mr. Gilmore that accompanied the recent article on *Monster Extinct Reptiles.*

The Meteorology of the Moon is an important paper dealing with the various phenomena from which lunar conditions are deduced. *Insects and the War* gives much information about nuisances that are not unknown in times of peace, and which are of serious importance in large gatherings of men, as in the armies of Europe. Other shorter articles of general interest are *The Visibility of Distant Objects in Warfare; Using the American Ephemeries*, which tells how to make your own almanac; *Alcohol in War; Quality of Limestone for Burning*, and *London Traffic.*

New Sludge Dryer Produced in Leeds

CONSIDERABLE attention has recently been directed to a machine for drying sludge, invented and patented by a firm in the Leeds district of England. It is claimed by the firm that this machine has made it possible to dry sewage sludge profitably, and that it is especially suitable for drying filter-pressed sludge cake containing moisture in any proportion up to 75 per cent. In reply to inquiries, the firm reports that the cost of converting 60 per cent sludge cake through the machine, including interest and repayment of capital, has been $1.94 per dry ton, while the fertilizer is worth $7.30 per ton and upward, according to the amount of ammonia it contains.

Strategic Moves of the War, March 10th, 1916

By Our Military Expert

THE Teutonic pounding upon the Verdun salient still continues. Almost regardless of losses the German battalions have been hurled headlong into the maelstrom of defending fire, through which, with perfect organization, splendid valor and seemingly unshakable determination, assault after assault has been delivered. Up to Friday, March 3rd, it is estimated that 26 distinct attacks in force have been delivered under cover of the most intense concentration of shell fire ever known, with adverse climatic conditions existing, leaving the ground soft and treacherous to footing, and mostly through blinding snow.

To either side of the salient proper, activities have been extended, as far to the southeastward as Metz, near Pont-a-Mousson, and to the westward through the Argonne into the Champagne. While there exist intervals in this hundred-mile line where concentrated activity has not developed, it is all part and parcel of the main assault upon Verdun, a constant pecking at the flanks of the salient that opposing troops may be held in position and that a weak point may be uncovered. The jaws of the German pincers are grinding away, striving to isolate the forces defending the salient, while strong attacks continue in efforts to crush in that portion of the line nearest to Verdun, directly to the north of the city.

This Verdun operation can scarcely be a direct attempt to break through to Paris, as a glance at the map will show. The distance from the Verdun position to Paris is almost three times as great as that from the nearest German position on the Aisne west of Soissons. A break through Verdun would inevitably result in French retirement to another defensive position in rear which would necessitate clearing before the German forces could proceed farther. Southeast of Rheims, the Marne forms another stout barrier, with Chalons sur Marne and Vitry le François as strong points of rest; and if that line should be forced, other positions lie in rear.

Each assault — field-besiegement—so required, fearfully increases losses, in proportion to the distance from the objective, admitting Paris as objective. From the Aisne to Paris offers then a proportionate saving that would certainly be seized upon were Paris the first objective. It is therefore upon this relative distance deduction is made that Paris is not the present target.

But that it is the ultimate one can hardly be doubted. The method of approach may be compared in a homely way with the opening of a securely nailed box. A wedge is inserted at one point until a little opening is made; then another portion of the lid is attacked; further on, another one and so forth, until gradually the entire nail-distance is gained. Possibly the activity on the western front may resemble such an operation as the spring unfolds.

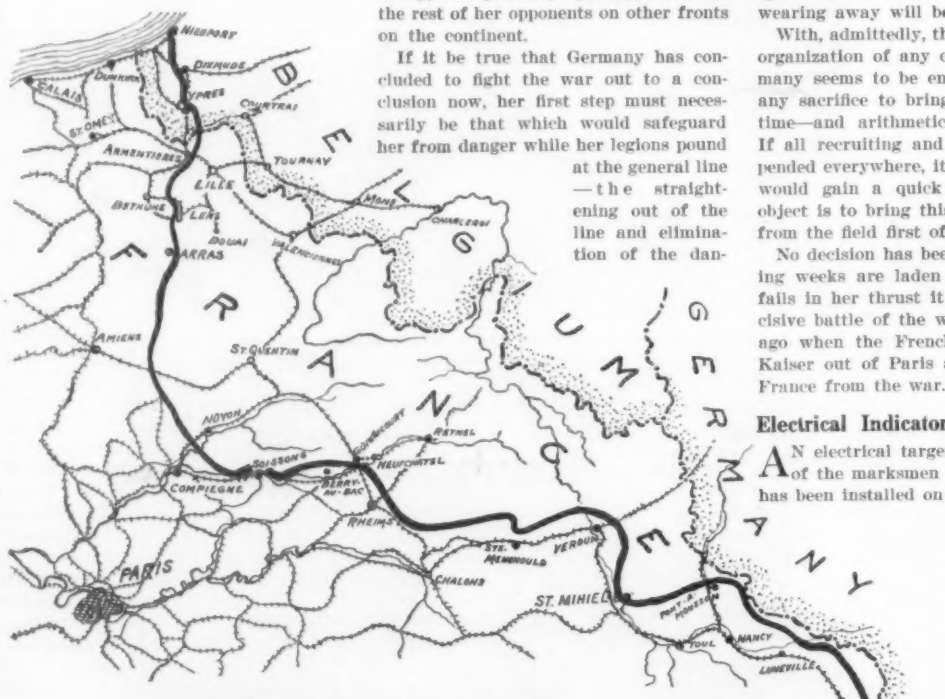
The successful penetration of the Verdun salient by Germany, to an appreciable depth would automatically require an adjustment of the French line for a considerable distance, threaten communications, or else leave a dangerous salient projecting into France which would furnish Germany interior lines for rapid shifts of force and make lateral communications for the French line extremities harder and longer. It would establish a threat against much French territory and secure possession of the important railway from St. Hilaire du Temple, southeast of Rheims, to Verdun, and the Meuse, with its paralleling railway from Verdun to Toul.

But the gaining of these things alone scarcely seems sufficient to counterbalance the tremendous losses which have been and will be incurred by the assailants. The great chain of the main barrier fortresses would be broken by the fall of Verdun; but that is scarcely enough in these days of huge field armies.

The most important gain, short of decisive French defeat, that could accrue to Germany would be the elimination of the threat against Metz and the way into Germany, which is definitely established by the existence of the Verdun salient. The writer of these lines holds no brief for either Entente or Teutonia, but he does entertain the belief in common with many others that the cold, hard numerals of arithmetic cannot be ignored; and arithmetic as expressed in the population and resource compilations of strictly neutral and non-military actuaries definitely states that the valiant Teutonic coalition is outnumbered two to one; and if the war *lasts long enough*, each side giving man for man, the stronger numerically must inevitably win.

The whirlwind and spectacular German assaults upon Verdun bear this out; it must be realized in Germany as well as elsewhere. For Germany to win a definite decision, she must triumph speedily before a war of attrition can weaken her too much. For this reason, then, it appears entirely worth while that Germany should bend every energy towards forcing an immediate decision by sheer force of arms. Despite appalling losses, despite the risk of weakening other fronts and drawing heavily upon general reserves from within the heart of the Fatherland, despite the possibility of strategic error or a definite reverse, if Germany could bring the war to a close on the western front, she could easily, and probably speedily, dominate the rest of her opponents on other fronts on the continent.

If it be true that Germany has concluded to fight the war out to a conclusion now, her first step must necessarily be that which would safeguard her from danger while her legions pound at the general line — the straightening out of the line and elimination of the dangerous Verdun salient. Should that be once secured, Germany would be at liberty to bend every resource to direct assault upon Paris by the shorter route or to continue her efforts along the southward line with the object of cutting off the main body of the French army to the northward from its French territory of supply. It is evident that a passive policy of waiting, in the face of superior numbers and resources could have but one result; and Germany is not waiting.



The battle line on the western front

It is claimed by many observers and statisticans that Germany has passed the zenith of her man-power, through losses and the extension of her lines. That may be; but it is also the general belief that for defensive purposes there are a sufficient number of troops to man her lines so that they could be broken only with the utmost difficulty. And, concomitantly, the Entente lines should be as hard to break.

It would be ridiculous to believe that the Entente is willing for the war to terminate only in a draw. There would then result no definite gain of any description to either side to pay for the losses incurred. The Entente tactics in the present situation are therefore puzzling. It would appear as though now is the one time for a huge offensive return elsewhere, either on the western front at another point, or on the eastern, by Russia. But with the exception of somewhat sporadic activities by the British in Flanders, the other sectors seem silent as so many tombs. Weather conditions may account for the withholding of a Russian thrust, for the ground at present does not favor handling of troops and supplies by road, with railways lacking to adequately cover a long general front. There must be at least 4,500,000 Entente troops, British, French and Belgian on or in rear of the western line, which would leave at least a million men available for a thrust. Naturally, if such a thrust is in preparation, every effort will be made to conceal it until such time as it is forthcoming; this may account for the apparent torpor.

Again, it may be that France feels so secure behind her defenses, that she is willing for Germany to dash her spiked head against the holding lines and count the cost afterwards. Such losses, which must necessarily be greater to an attacker than to the defense, would count in the policy of attrition, and perhaps France is still carrying on the tactics that have signalized her campaign since the battle of the Marne. Perhaps a massive counterstroke will be delayed until a decision has been reached in the battle of Verdun when, if the French lines hold, it will have been demonstrated rather definitely that deadlock in truth does obtain and that even more time must be consumed in attrition before the opposing forces are sufficiently weakened to render successful Entente assault probable.

Each day gained without a decision means so much benefit to the ponderous Bear, the country that in the end will probably count heaviest through her unwieldly strength; each time-gain aids unprepared England; France is probably now at her greatest strength.

And each day that passes without decisive result must spell loss to Teutonia, even though it be small; the wearing away will be in progress.

With, admittedly, the highest development of military organization of any country engaged in the war, Germany seems to be entirely justified in making almost any sacrifice to bring the war to a speedy close, for time—and arithmetic—are her most feared enemies. If all recruiting and supply activities should be suspended everywhere, it is highly probable that Germany would gain a quick decision, and her most sought object is to bring this about by elimination of France from the field first of all.

No decision has been reached thus far and the coming weeks are laden with moment. But if Germany fails in her thrust it may safely be said that the decisive battle of the war was fought almost 18 months ago when the French stand on the Marne kept the Kaiser out of Paris and prevented the elimination of France from the war.

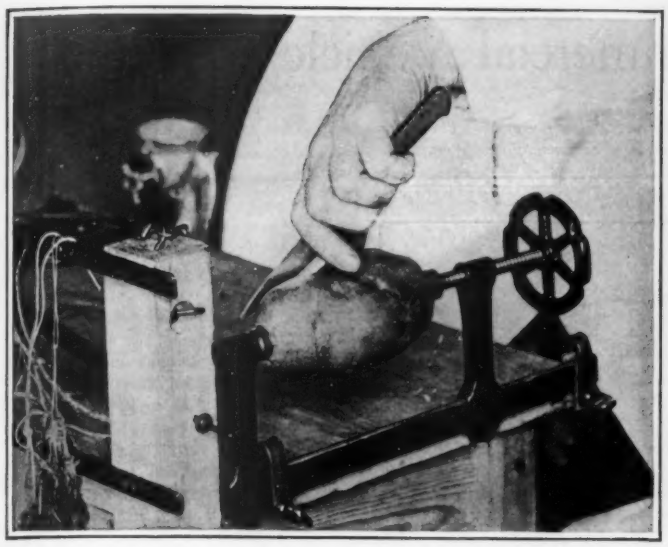
Electrical Indicator of Scores for Rifle Ranges

AN electrical target that signals the exact accuracy of the marksmen to an indicator on the firing line has been installed on the shooting range of the United States Marines at San Francisco. The method of signaling the accuracy of shots now employed on most Government ranges has been criticised, as it has been difficult to convey to the men on the firing line the explicit information as to the closeness of his shot to the bullseye. An elaborate system of flag and disk signaling is usually employed. This requires on long-distance ranges the use of field glasses. When the marksman fires a shot at a target the spotter in the distant pit lowers a target and raises a signal to denote the numerical accuracy.

The procedure requires a large corps of men both in the pits as spotters and on the range behind the marksmen as scorers. Moreover, it has often proved confusing and there is no way of signaling whether the bullet that missed went too far to the right or to the left; too high or too low.

The electrical target in appearance resembles a number of large ventilating fans superimposed one upon the other, each one smaller than that beneath it. The bullseye is a thick metal disk, painted black, which extends in front of the blades. Steel plates are used in the construction and behind the steel plates are electrical contacts.

On the firing line is an electrical indicator, which in design is a replica of the target. Each leaf of the target is represented by a minature electrical lamp on the indicator. When a bullet strikes one of the blades of the target, the contact made closes an electrical circuit, consisting of batteries, a cable to the indicator, and one of the lights of the indicator. The action is immediate, the marksman knowing at once not only his score but the exact place on the target where the bullet struck, so that he can adjust his rifle sights to conform with wind and temperature conditions. The target and indicator are marked to resemble a clock face.



Peeling potatoes with the use of an adjustable clamp

Complete kitchen equipment for the one-armed soldier-cook

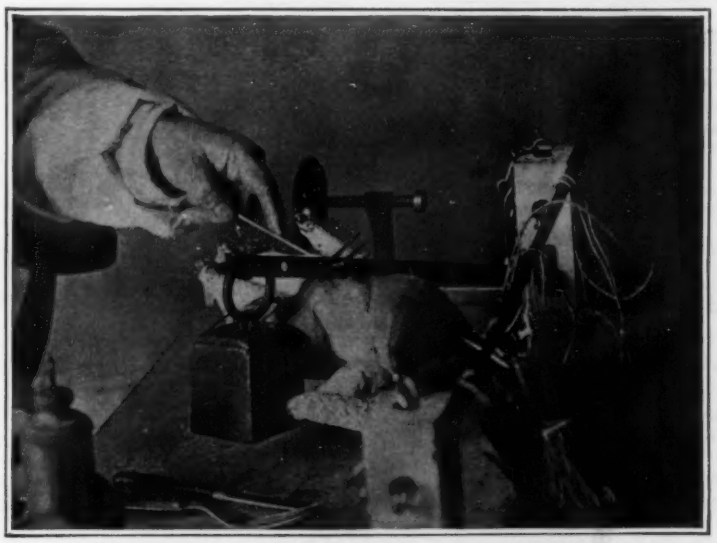
Kitchen Equipment for the One-Armed Soldier-Cook

IN view of the many operations involved in the cooking of an ordinary meal, not a few of which are at once delicate and complicated, it would appear that this occupation is not one to be engaged in by a one-armed man. Yet recently there has been demonstrated in England the feasibility of one-armed cooks in the near future; indeed, the culinary field offers a most attractive opportunity for many of the war's victims who have lost the use of one of their hands.

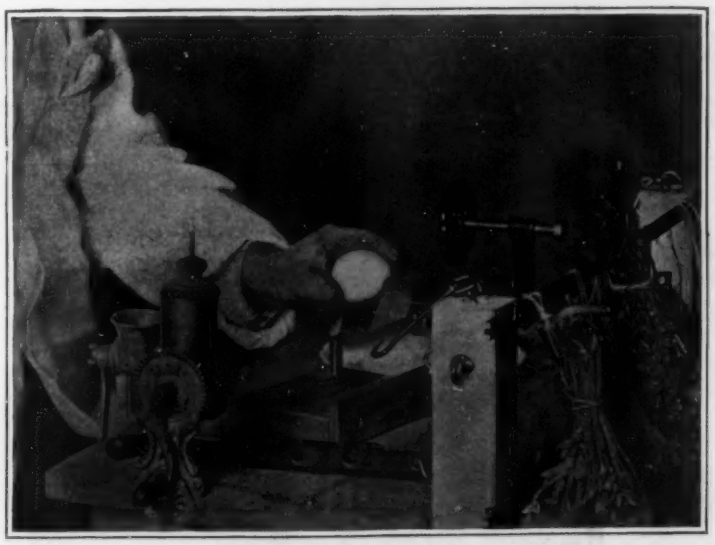
In its untiring endeavors to create tasks and occupations for disabled English soldiers, the Society of Medical Officers of Health has found a promising field in the kitchens of hotels, restaurants and even households. Recently the secretary of the organization, William Lawton, gave an interesting demonstration of the use of a number of simple contrivances and a specially constructed stove which he has devised to enable a one-armed person to undertake the numerous duties of a cook. All of the contrivances which he used are of the simplest sort; in fact, they may be made by any one from odds and ends usually found about the house, and from clamps procurable at any hardware store.

In the four accompanying illustrations are depicted the simple contrivances devised by Mr. Lawton, as well as the method of using them. In the first view is shown a simple clamp, which serves to hold potatoes or apples which are to be peeled. It will be noticed that the clamp is adjustable so as to take any vegetables or fruit irrespective of their size. While allowing that this method of peeling may perhaps be cumbersome as compared to the usual procedure, it is claimed that with proper practice the user soon becomes skilled in the work. In another illustration is shown how a chicken is held securely while being cleaned and dressed, the device in this case consisting merely of a hinged metal arm on the free end of which is placed a heavy weight. On the arm is an adjustable fork-like member which may be used for holding the chicken, or for that matter any other kind of meat, should it be found necessary. How an egg may be readily broken with one hand without losing any of its contents is shown in another view; in this instance a trough-shaped piece of sheet metal with a sharp ridge is used to break the egg cleanly in half and gather the yolk and white of egg into the dish below. The meat chopper, which is conspicuous in this and other views, is an indispensable tool of the one-armed cook. In the remaining view appears the entire equipment devised by Mr. Lawton, including the special stove, which in this instance is of small size and presumably intended for the usual household. This stove is made in the form of an oven, with wire-work shelves for holding the different foods that are to be cooked.

Mr. Lawton has devoted considerable thought to the devising of the various contrivances whereby a one-armed person can cook almost as readily as the more fortunate individual. In order that his demonstrations might be conducted under the most realistic conditions, Mr. Lawton had one of his arms tightly bandaged across his chest so that it could not be used.



Cleaning and dressing a chicken with one hand, while holding it with a weighted arm



Breaking an egg with one hand, using a trough-like device

False Flax, A Little-Known Plant of Value

AMONG the little-known plants which have been introduced from Europe is the false flax or gold of pleasure. It was first brought into this country as an impurity in flaxseed and clover seed, and it is now pretty generally distributed wherever flax is cultivated. The false flax is a member of the mustard family of plants and is called *Camelina sativa* by botanists. Its generic name is derived from the Greek meaning false flax, so-called because it invariably grows with flax which it resembles in a general way, only it is slightly smaller and its seed pods are pear-shaped instead of spherical.

Although false flax is regarded as a weed in cultivated fields, it is nevertheless a plant of considerable merit and should be drawn to the attention of agriculturists and others as an oil plant adapted for feeding cattle and for other purposes. It forms a well-known crop in Europe, and its cultivation there dates back to the eleventh century. From that time on it has been planted more or less extensively in Holland, Germany, Russia and Turkey. It is believed that its cultivation in this country would repay the farmer, because an acre of false flax yields about 32 bushels of seed, of which from 30 to 32 per cent is oil, which exceeds that of true flax. Judging from observations made in this country, it flourishes on barren, sandy soils where no other crops will grow successfully. Being independent of drought, the plants grow vigorously and yield a large crop. It does not exhaust the soil like the corn crop, for instance, but it may be planted after the corn crop without doing the least injury to the land.

The best time to sow the seed is in the fall, requiring about 15 pounds of seed to the acre, sowing it broadcast. The seeds will germinate in the fall and produce a rosette of leaves similar to dandelion. In the spring the plants will develop stalks which mature the seed pod in June and July. Care must be taken to cut it before it becomes too ripe or the seed will be lost. As soon as the pods change from green to golden, they are ripe, and should be harvested and prepared for market in the same manner as wheat and oats. The cultural methods for this plant are the same as those for true flax.

The false flax seeds produce a finer oil than rape or true flax; besides the use of the seeds for oil which is employed in the manufacture of soap, lubricating oils, etc., the oil cake has been found highly nutritious in the fattening of cattle and sheep. These cakes constitute masses of seed from which the water and oil has been deprived by mechanical means. Not only are the seeds valuable, but the stems of this plant yield a fiber which is used in parts of Europe for making coarse cloth.

Leaf Margins as an Indication of Climate

A RECENT paper by Messrs. I. W. Bailey and E. W. Sinnott calls attention to a striking correlation between the character of leaf margin, especially in trees and large shrubs, and the prevailing climatic influences, a relation that is of interest in studying the climates of past geological ages. Leaves and leaflets with entire margins (*i. e.*, not broken by teeth or serrations) are overwhelmingly predominant in lowland-tropical regions; those with non-entire margins in mesophytic cold-temperate areas. In the tropical zones non-entire margins are favored by moist uplands, equable environments, and protected, comparatively cool habitats; in the cold-temperate zones, entire margins are favored by arid environments. The authors suggest that "the determination of the percentages of entire and non-entire leaves in Cretaceous and Tertiary dicotyledonous floras affords a simple and rapid means of gaging the general climatic conditions which existed in the regions where these plants flourished."

The Motor-driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M. S. A. E.

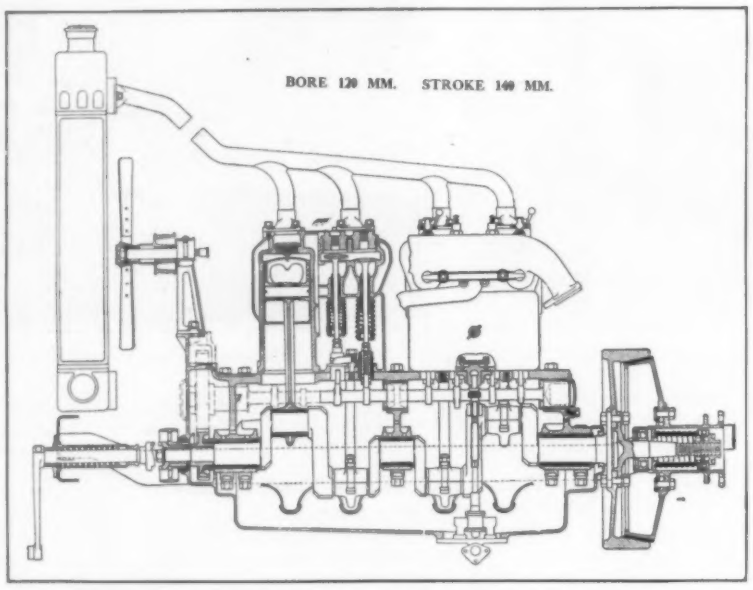
This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles

Foreign Motor Truck Subsidy Requirements

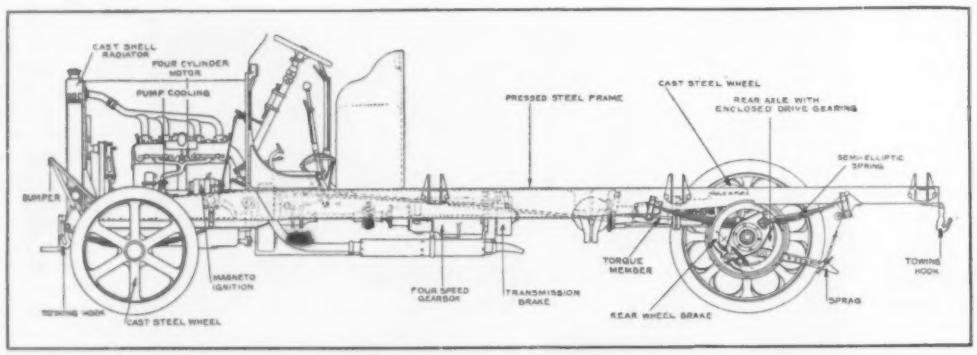
LONG before the outbreak of the present war the belligerent powers had understood that the motor truck would be of marked utility, not only for transporting the munitions of war, such as food, arms, aeroplanes and the personal impedimenta of large bodies of men, but also for conveying the soldiers themselves. It is apparent that an enormous sum of money would be involved if the various governments were forced to purchase outright a large enough number of vehicles for war purposes, and not only would capital be tied up, but the motor trucks would remain idle until the outbreak of hostilities made their use necessary.

The solution of this problem was that all who owned motor trucks which were built to follow certain basic requirements could, by suitable registration, avail themselves of the financial assistance provided by the subsidy, which meant that they would receive a regular stipend issued periodically, or a large cash payment that would be of material assistance in helping pay for the trucks. In case of war, all the trucks must be delivered to the government upon its request and a definite, previously agreed upon price, given to the owner of the vehicle.

It will be apparent that, in operating thousands of commercial vehicles, it would be highly desirable to have all of these conform to certain standards, in order to reduce the expense of maintenance and to insure continued operation of the trucks. It was the endeavor of those responsible for the subsidy rules to have as many as possible of the components of the various trucks interchangeable to some extent, even if these were of different makes.



Typical four-cylinder engine used on English class A subsidy trucks



Side elevation of class A subsidy model three-ton chassis that conforms to the English requirements

In view of the present agitation on the subject of adequate preparation of defense in the United States it would seem desirable that some effort be made to standardize certain types of trucks as being best adapted for war service, and even if no subsidy were offered it is highly important that a set of rules be formulated by competent engineering authorities in the employ of the government, so that builders of trucks could design certain types that would be similar in many respects to those of like pattern built by other manufacturers. There are, at the present time, several hundred different models of motor trucks produced in the United States, and while all of these fill a logical demand in the industrial field it is very unlikely that they are all suitable for army purposes.

In order to show how the foreign trucks subject to the subsidy have been standardized, we will review, briefly, the most important specifications, so that those familiar with motor truck construction can judge which of our American motor trucks would be preferred by European governments. Considering first the British specifications, we find two types of trucks are considered desirable: the type A being of three tons capacity, while the type B is of 1½ tons capacity. The body type is a simple platform with detachable sides 2 feet high. The tires of the type A truck are 900 x 120 millimeters, single, for the front wheels and 1,050 x 120 millimeters, dual, for the rear wheels. These are equivalent to our American dimensions as follows: 35.40″ x 4.72″ front, 41.33″ x 4.72″ rear. On the type B, or lighter truck, the front tires must be 870 x 100 millimeters, single, and the rear are 1,030 x 100 millimeters, dual. The wheels should be of steel, 881.6 millimeters diameter (34.724″) for the 1,030 and 1,050 millimeter tires and 719.8 millimeters (28.25″) for the 870 and 900 millimeter tires.

The power plant of the type A trucks are four-cylinder engines having a minimum bore of 4½ inches at a minimum rating (R.A.C.) of 30 horse-power. The type B engine is also a four-cylinder pattern having a minimum bore of 4 inches and a minimum rating of 24.8 horse-power. The cylinders are to be cast in pairs having mechanically operated valves with enclosed valve stems. The motors should be provided with automatic speed governors and cooled by pump operated cooling systems. The power plant and its auxiliary units must be located at the front of the chassis, under the bonnet, and all parts must be accessible for inspection or adjustment. The ignition is by high tension magneto having the shaft center 50 millimeters from the supporting flange or base piece. The radiators must be the tubular form having substantial cast metal frames and must be located above the frame. Two outlet connections are to be provided and the radiator must be protected from damage in event of collision by a bar. Lubrication must be by positive driven mechanical pump and the system must have oil capacity for 200 miles.

The transmission should have four speeds forward and one reverse and should be geared to have a ratio of at least 5 to 1 on high. Shaft drive is specified and torque members and radius rods must be provided as the springs are to sustain only the weight of the vehicle and not to resist either braking or driving torque. The hand brake lever must operate so that it is necessary to push it to set the brake. The foot brake is to operate on the propeller shaft as foot brakes operating on rear wheels will not be accepted. The hand brake acts on the rear wheel hubs. Either brake must hold the vehicle on a grade of 1 in 5. The wheel base of the type A must not be less than 156 inches while that of the type B must be a minimum of 126 inches. A 30-gallon fuel tank should be fitted. The gasoline consumption should not be greater than one gallon per 40 ton miles. Engines must develop their R.A.C. rating. The truck must be able to climb a grade of 1 in 6 fully loaded. Two towing hooks must be fitted to the front and

(Concluded on page 311)

Angle of inclination necessary to dump crushed stone with regular express body construction

Motor Truck Queries

W. V. H. writes: We are designing a special dumping body for use on one of our five-ton chassis intended for general contracting work and hauling materials for road construction. What degree of elevation would be required to have various materials flow by gravity. Are there any data available on this subject? What is the best material to use in body construction? A. By all means use either a steel body, or at least, a steel lined wooden body. Wood used alone would soon be worn away by the materials hauled, and besides, it will have to be tipped more to dump clinging materials, such as wet ashes, than a steel body will. A series of tests by Morris A. Hall gives the following minimum angles with the horozontal at which various materials can be completely dumped from a flared side, steel lined truck body:

Material.	Angle Degrees.
Dry ashes	33
Wet ashes	34 to 36
Very wet ashes	29 to 30
Concrete or garbage	30
Sand	29
Broken stone, No. 2 sand	27
Soft coal	30
Coke	23

From the foregoing it will be evident that an angle of inclination of 35 deg. will take care of any material used in road construction. The reason it takes less inclination to dump very wet ashes, concrete or garbage than dry ashes or barely wet ashes is that water becomes a lubricant if used in large quantities and acts only as a binder if used in small amounts. Bear in mind, the interior of the body should be smooth as possible and lining bright. Projecting bolt heads, cleats, braces, nuts or rivets will retard the flow of the material when the body is raised.

Scientific American War Game

What do you know of the science of war?

Knowledge of military strategy and tactics is obtained by a game of war played with pins and blocks and paper strips upon a contour map. The game is as scientific and absorbing as a game of chess. We invite our readers to participate in such a game.

WAR HAS BEGUN!

I.

In the SCIENTIFIC AMERICAN of March 11th we published the first paper of the war game series. Enemy patrols had been observed ten miles beyond "Lookout Hill." To gain information about the enemy, four cavalry patrols were sent out from the detachment stationed at "Norrisville." How are these patrols to proceed so as to get in touch with the enemy, discover his whereabouts, and at the same time avoid discovery by the enemy patrols?

II.

March 25th. In this installment, the findings of the cavalry patrols are announced, the detachment which has moved forward, encamps for the night and takes measures to protect itself against surprise attacks. What measures should be taken?

III.

April 8th. The detachment now moves forward to a strategic position to engage the enemy in battle. What disposition should be made of the artillery, infantry, and cavalry?

IV.

April 22nd. In this issue battle is joined, and our readers move over to the side of the enemy to learn of the measures taken by the enemy to defend itself.

In each installment problems are presented for the readers to ponder over. Military science is as exact as that of chess. These problems have definite answers, and the answers in each case will be found in the following installment.

This war game series is being conducted by Lieut. Guido von Horvath, formerly of the Austro-Hungarian Army, who is eminently fitted to teach military tactics by reason of his training at the Military Geographical Institute at Vienna.

In strict military parlance the first four installments of the series are known as "map problems." A real war game will follow, when two military tacticians will be pitted against each other in military maneuvers. Announcement of this game will be given later.

An enlarged map printed in colors covering the terrain of the war games has been prepared and may be had for 10 cents.

The articles are written so that laymen can understand them.

MUNN & COMPANY, Inc.
Woolworth Building - - - New York

Industrial Preparedness for Peace

(*Concluded from page 300*)

which it will leave the world. It would therefore be equally impossible to speak definitely of business preparedness. This, however, we can say. When the war closes, there will be a sudden cessation of demand for many manufactured articles and a corresponding decline in price. The price of agricultural products will also decline, and business generally will be disturbed. The best way to prepare is to reform present habits of extravagance, put by profits being made now for a rainy day. Wages, of course, must decline with lower prices, and there will no doubt be many industrial disturbances and much suffering throughout the world, all of which the world will richly deserve, as it is engaged in the most barbarous warfare in all its history. Foreign competition will, of course, be keener than ever before and the Government should do all in its power to foster and assist our business interests, or, at any rate, as the man said in his short prayer to the Lord during a tussle with a grizzly bear: 'Oh Lord, if you can't be on my side, please don't be agin me!'"

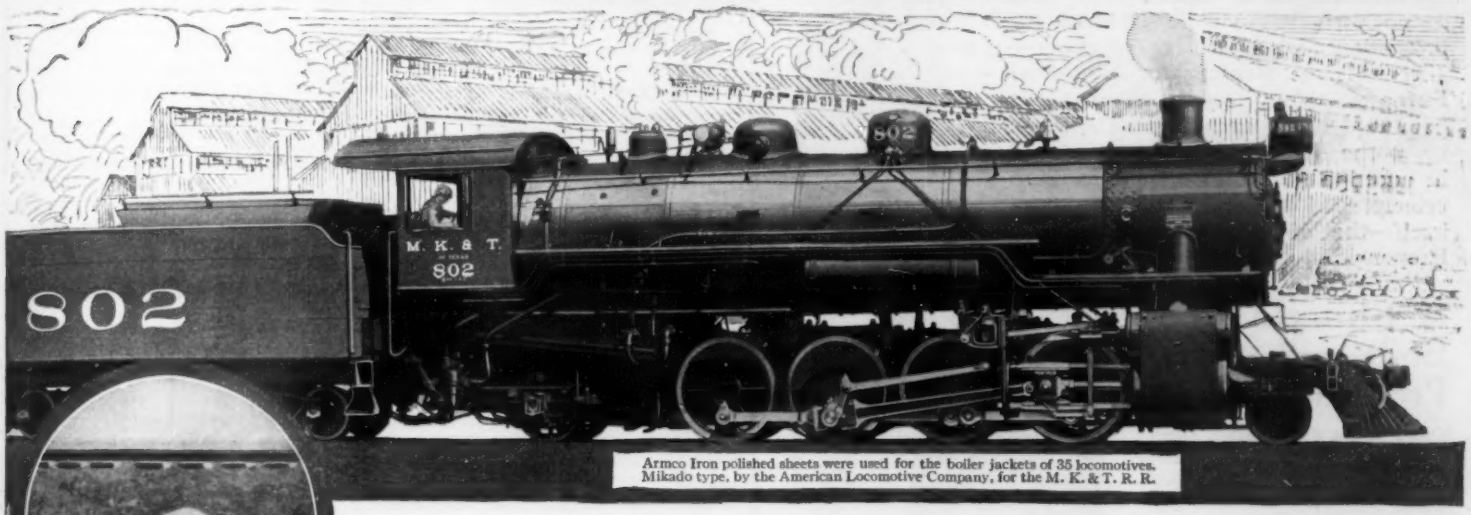
Prof. THOMAS N. CARVER, Department of Economics, Harvard University:

"In the *New York Times Annalist* for January 3d, I have an article on the subject of redistribution of population following the war. That will give you my opinion regarding some of the questions which you raise in your letter of January 8th. I read a paper before the Pan-American Congress entitled: 'The Conservation of Human Energy,' which gives my views regarding some other problems connected with your subject, namely, 'Industrial Preparedness for Peace.'

"I may say that in my opinion purely business questions and questions of shop management, business efficiency, etc., while important in themselves, are secondary to more fundamental questions such as the morality and self-discipline of a people. The greatest of all industrial engineers is the moral leader, provided his moral system is rational. Real immorality is nothing in the world excepting waste or dissipation of human energy. Real morality is nothing in the world except the economy and utilization of human energy. The reason it is better to tell the truth than to lie is because a community in which truthfulness prevails will waste less energy than a community where lying prevails. There can be team work and economy of effort in an honest community; there can be no team work, but only waste of effort, in a dishonest community. Honesty is one of the greatest labor-saving inventions ever devised. This may be said of any other form of morality which is genuine and not merely conventional. Therefore, it seems to me that economists, businessmen, and statesmen should give more attention to those fundamental moral questions which are all reducible to the economics of social energy. Our greatest waste is the waste of men. A man goes to waste when his productive energy is not fully utilized, when he is dissipating it in private vice, or when social morality is so poorly developed that he has to spend his time watching his neighbors, and they likewise have to spend their time watching him.

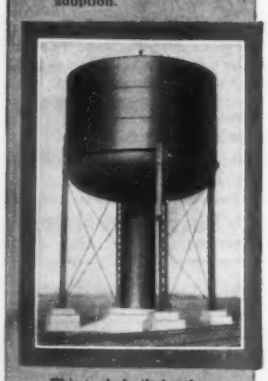
"Again, litigation among the citizens of a country is only a little less wasteful than war. To kill men in war stops their productivity, but it also saves their feed. For a man to spend his time, as a lawyer, in fighting private battles, destroys his productivity just as effectually as though he were killed; and you do not save his feed but have to go on feeding him just the same as though he were producing something. In short, the more people we have engaged in non-productive litigation, the fewer we have left to do the productive work. When we realize that we support more lawyers and waste more men in court proceedings than any other country, we will not be so ready to

America's Leading Railroads Use Armco Iron– the Iron That's Made to Last

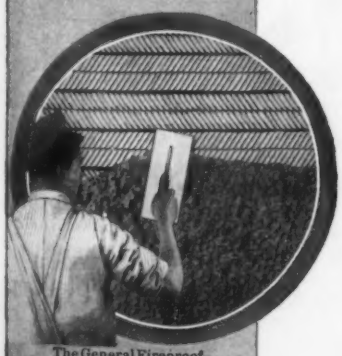


Armco Iron polished sheets were used for the boiler jackets of 35 locomotives, Mikado type, by the American Locomotive Company, for the M. K. & T. R. R.

The rust-resistance of Armco Iron Culverts has led to their general adoption.



This tank, built for the C. & E. I. R. R. has an Armco Iron bottom.



The General Fireproofing Co., Youngstown, O., make Herringbone Lath from Armco Iron.

THE leading railroads of America quickly gave rust-resisting Armco (American Ingot) Iron a trial as soon as it was made in commercial quantities.

They used it first in a few culverts. Today thousands of Armco Iron culverts are resisting the corrosive action of impure water along the railroads and are standing up under the pounding of the heaviest freights of our history. This service led to broader uses. Armco Iron roofing and siding proved their worth because

ARMCO IRON Resists Rust

Armco Iron now goes into freight and passenger cars, locomotive boiler jackets, boiler tubes, equalizer bars and fence posts, Page Wire Fencing, (Monessen, Pa.). Water tanks, gasolene and oil storage tanks, ventilating ducts, window frames, metal lath, tie plates—these are but a few of the products that are more durable and hence cheaper when made of this metal.

Rust-Resisting Property was one of the special characteristics of Armco Iron recognized by the metallurgists who awarded Armco Iron the Grand Prize, the highest possible award, at the Panama-Pacific Exposition.

The great rust-resistance of Armco Iron is due to its remarkable purity, and to the scientific care and rigid inspection which characterize its manufacture. Armco Iron has unusual workability, superior enameling quality, perfect welding properities and high electrical conductivity.

The heating and ventilating plant of the Kansas City Union Station contains 300,000 lbs. of Armco Iron.

Write for "Defeating Rust"

Let us send you this book—the truth about rust and how Armco Iron will save you money by resisting the great destroyer. Send for book and data on the product of interest to you.

THE AMERICAN ROLLING MILL CO., Box 771, Middletown, Ohio

Licensed Manufacturers under Patents granted to The International Metal Products Company

Branch Offices: Chicago, Pittsburgh, Detroit, New York, St. Louis, Cincinnati, Cleveland and San Francisco

AMERICAN ARMCO INGOT IRON

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by The American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

The roofing of this car is of Armco Iron

Let us send full information regarding Armco Iron Fence Posts and Armco Roofing.

point the finger of scorn at the militant nations.

"The real source of wealth and prosperity is the fund of human energy, or power to do productive work, both mental and physical. The more this is wasted in vice or dissipation, in idleness or leisure, in luxury or over-consumption, in ignorance or lack of skill, in litigation or internal conflict, in unscrupulous bargaining or predatory enterprise, the less there is left for the really productive work which alone can create prosperity. When we consider all these possible sources of waste, we shall find that war is not necessarily nor always more wasteful than peace. It is quite possible, and by no means uncommon, to waste more in the vices of peace than in the destructiveness of war."

A. B. Cushman, General Manager, National Grocer Company, Detroit:

"The writer has heard some talk regarding the possibilities of extending trade relations in our line to South American countries, but unless these countries discontinue the tariff on American canned goods, little or nothing can be accomplished. I believe that trade relations with all countries is a subject which needs our earnest consideration now, and it should be scientifically considered. A Tariff Commission should be named, whose duty it would be to gather statistical information from all countries and record it in such way as to make it available when Congress has occasion to act on tariff matters."

Million-Volt Commercial Frequency Transformer

(*Concluded from page* 299)

capacity types of this device may be connected directly to very high potential mains for stepping down the current, thus bringing about a tremendous saving in installation and affording the small consumer and the far distant one an opportunity hitherto denied him by both excessive cost and inaccessibility of power.

The transformer could be safely operated for six hours at 200 per cent over load without injury to the insulation, due to the excellent cooling surface of all primary and secondary coils. It could be safely operated for 24 hours at 100 per cent overload. It could stand a short circuit on the secondary for five minutes with the primary operating at full potential.

The demonstration areas on the exterior of the building were fitted up by engineer A. S. Lindstrom, assistant to the inventor and in charge of the installation and operation of the coil, with numerous devices designed to collect and convey electrostatic charges generated by the coil. To admit of crowds to experiment individually and collectively with this electrostatic energy, he brought out of the transformer house by means of long prepared rope insulators, the million-volt end of the coil and connected it to a wire screen formed of bare crossed wires 50 feet square and suspended 30 feet above the earth. Some idea of the strength and effect of the electrostatic stress contained in this overhead system when energized by 400 horse-power at a potential of 500,000 volts may be had from the fact that when an automobile drove up on its insulating rubber tires to a point within 25 feet of the screen, a person could step up and draw a spark and shock from any metal part of it.

At a point 10 feet beneath the charged wire screen a second insulated rope screen or protecting net was arranged. So great was the charge it carried under the same conditions that the writer himself drew from it with a grounded conductor sparks 2 feet in length, accompanied by miniature thunder claps.

On the ground beneath the rope protecting screen dozens of persons at a time were nightly beheld moving about under difficulty through the energized space, like divers penetrating their way through water. A person could there stand on an insulating box and impart sparks 3 and 6 inches in length to other individuals; and even the face when held skyward felt the energy being dissipated from it in

various forms, one evidence of which was in the easily detected presence of ozone forming at the very nostrils. When standing on the ground the hat could be raised off the head by one hand with a discharge of sparks and prickling sensation. If held in the air, a half inch spark could be drawn from the hand by the thumb of the same hand. When the hat was held near the head the same sound or hum that is experienced in the presence of alternating current generators was audible. When vacuum or Neon and Helium gas tubes were brought under the charged screen all manner of interesting displays occurred therein. One striking result was the visible effect of the passage of the alternating charges of positive and negative potential in flowing between the screen and the earth, when the vacuum tubes were held perpendicular and moved slowly back and forth horizontally. At different positions in the horizontal movement they would catch a positive or a negative flow and exhibit it to the eye, there being a separate form for each kind of potential. Strange, unexplained behavior of the tubes also occurred, proving in the existence of such a hitherto unachieved condition of electrostatic stress a new and fruitful field of scientific research. When the outdoor aerial system was charged to a high degree it became luminous, some parts showing a corona of 6 inches about them. One of the interesting spectacular demonstrations was that of causing great surges throughout the system by intermittently discharging the stress in the screen to a grounded jet of spouting water breaking upward on a suspended metal disk, the latter being connected to the screen. The resulting noise was terrific, the sight beautiful yet awe-inspiring, and the magnitude of the corona and luminosity startling.

Foreign Motor Truck Subsidy Requirements

(*Concluded from page* 306)

two to the rear. Two independent sprag bars located on the rear axle must be easily operated by a handle at the driver's seat.

The French specifications do not go into such minute detail. There are three classes of trucks, the largest one of 4,408 pounds capacity or about two long tons. The Colonial truck should have a capacity of 3,306 pounds, while the four wheel drive trucks, a classification that we do not find at all in the English specifications, have a carrying capacity of 3,306 pounds, this not including the load on trailers operating in conjunction with them. The body type is a platform with box and cover. The regular top is the form used on the well-known American prairie schooner. The front tires may be from 770 to 1,000 millimeters in diameter (30 to 40 inches) and 90 to 180 millimeters in width, single, (3½ to 7 inches). The rear tires must be 205 to 325 millimeters in width, dual, (4 to 12 inches). Tires must be solid rubber. No pneumatic, cushion or block tires accepted.

The engine must be a four-cylinder form fitted with high tension magneto. Greater latitude is allowed than in the British specifications as no attempt is made to dictate the character of the cooling or lubrication system or the dimensions of the engine. The transmission must have four speeds forward and reverse. The braking capacity must be such that the vehicle can be stopped with but one set of brakes within 50 meters (160 feet) on a 12 per cent grade. The towing hooks and sprag requirements are the same as in the British specifications. The fuel tank must have capacity for 200 kilometers (125 miles) and the water capacity should be sufficient so that the same distance can be covered without any need of replenishing the supply. The engines must operate with gasoline, alcohol, or benzol. Fuel consumption must not exceed six centiliters per ton kilometer for any kind of fuel. Consumption of lubricants must not exceed 5 grams (about five fluid ounces per ton mile) per ton kilometer or .352 fluid ounces per ton mile. The truck must be able to tow another loaded car up an 8 per cent grade.

The writer does not intend to offer these specifications as suitable for the requirements in the United States, though very complete specifications of trucks adapted for our use should be prepared and submitted to all manufacturers of trucks by the government. It would seem that our peculiar highway conditions would make a class that would cover the four-wheel drive truck just as imperative as in France. It would be wise also to limit the power plant to four cylinders and have only four speed gear boxes. Final drive by entirely enclosed drive gearing is preferable to any other form and the control could be standardized to advantage.

Operating Trains Across the Great Divide

(*Concluded from page* 298)

bring to bear considerable influence in causing other railways to electrify entire divisions of their roads.

The electrical power employed to supply the extended electrical zone of the railroad is obtained from a power company. The entire 440 miles of the route is supplied from fourteen sub-stations spaced at intervals of about 35 miles, each of which contains transformer equipment for stepping down the 100,000-volt alternating current to 2,300 volts, and motor-generator sets of either 1,500 or 2,000 kilowatt capacity, which furnish 3,000 volts direct current to the overhead feeder from which the locomotives obtain their power. In this respect the Chicago, Milwaukee & St. Paul Railway is unique, for it is the first direct current installation supplying current of such a high potential to the locomotives through the trolley wire, although the system was adopted in preference to all others after a careful investigation extending over two years.

The overhead trolley construction is of the catenary type, in which two No. 0000 trolley wires are flexibly suspended from a steel catenary supported on carefully selected cedar poles, the construction being "bracket" wherever direct alignment will permit, and "cross-span" on the sharper curves and in the yards. Steel supports instead of wooden poles are used in the yards where the number of tracks to be spanned exceeds the possibilities of wooden pole construction. The twin-conductors of the trolley system are suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This form of construction permits of the collection of very heavy currents by reason of the twin contact of the pantograph with the two trolley wires, and also assures sparkless collection under the extreme of either heavy current at low speed or more moderate current at very high speed. It appears that the twin-conductor type of construction is equally adapted to the heavy grades, calling for the collection of very heavy currents, and on the more level portions of the line, where maximum speeds of sixty miles per hour are reached with passenger trains having a total weight of 800 tons.

Under normal conditions forty-two immense electrical locomotives are required to haul freight and passenger trains over the electrified mountain divisions of the Chicago, Milwaukee & St. Paul Railway. These new engines, described at length in the SCIENTIFIC AMERICAN, Vol. CXIII, No. 19, page 392, resemble two large mail cars permanently coupled together. They weigh 284 tons each and will haul 3,200-ton loads trailing up a 1 per cent grade at an average speed of 15 miles an hour. Similar electric locomotives geared for a greater speed will haul 800-ton passenger trains over the same road at a speed of 60 miles per hour. To appreciate the immense tractive power of these locomotives one should know that the wood-burning locomotive of fifty years ago weighed 20 tons and had a tractive effort of only 5,000 pounds. The present day Mallet steam locomotive has a tractive power of 76,200 pounds, while the electrical locomotive weighing 284 tons has a tractive power of 85,000 pounds. The Chicago, Milwaukee & St. Paul electric locomotives are 112 feet 8 inches in length, and are driven by eight separate 430-horse-power motors, each geared to a driving axle, thus giving

a total of 3,440 horse-power. On down grades the trains are controlled by regenerative braking; that is to say, the motors are caused to act as generators, which exerts the required braking power and at the same time returns an appreciable amount of current back into the line.

The electric current for operating the electrified section of the road, as previously stated, is purchased from a power company. This company covers a great part of Montana and part of Idaho with its network of transmission lines, which are fed from a number of sources, of which the principal are as follows: Madison River, 11,000 kw.; Canyon Ferry, 7,500 kw.; Hauser Lake, 14,000 kw.; Big Hole, 3,000 kw.; Butte (steam turbine), 5,000 kw.; Rainbow Falls, 21,000 kw.; and small falls aggregating 7,390 kw. In all, these sources are to-day developing 68,890 kw., and further plans which are now in the course of realization will eventually add another 175,000 kw. to that figure, making a total of 244,000 kw.

The several power sites are interconnected by transmission lines; the earlier ones are supported on wooden poles and operate at 50,000 volts, and the later installations are supported on steel towers and operate at 100,000 volts. Ample water storage capacity (300,000 acre-feet) is provided in the Hebgen Reservoir, and this is supplemented by auxiliary reservoir capacity at the several power sites, which brings the total up to 418,000 acre-feet. The Hebgen Reservoir is so located at the head waters of the Madison River that water drawn from it can supply in turn the several installations on the Madison and Missouri rivers, so that the same storage water is used a number of times, giving an available storage capacity considerably greater than is indicated by the figures given. It would seem, therefore, in changing from coal to electricity as a source of motive power, that the railroad is amply protected as regards reliability and continuity of power supply. Due to the great facilities available and the low cost of construction under the favorable conditions existing, the railway company purchases power at a contract rate slightly more than one half cent per kilowatt hour, based on 60 per cent load-factor. Under these conditions the cost of power for locomotives is considerably less than that of a steam locomotive doing the same work.

NEW BOOKS, ETC.

THE UNIVERSE AND THE ATOM. The Ether Constitution, Creation and Structure of Atoms, Gravitation, and Electricity, Kinetically Explained. By Marion Erwin, C.E. New York: D. Van Nostrand Company, 1916. 8vo.; 314 pp.; illustrated. Price, $2 net.

Since recent developments seem to indicate that the atom is not indestructible, and the universality and general transfusion of energy seem to preclude the existence of isolated perpetual motion vortices, our author repudiates Lord Kelvin's conception of an ether vortex ring atom, and adopts instead a modification and expansion of Maxwell's theory. In presenting those conceptions of motion on which his conclusions as to the constitution of the ether are based, Mr. Erwin resorts to many ingenious and simple analogies and devices, and one great merit of his work is its care in keeping the discussion within the understanding of the ordinary educated intellect. In so far as the work deals with matter, it faithfully reflects the leading thought of the day; its views upon the constitution of the ether are stimulating and in the highest degree worthy of a hearing; their confirmation or refutation must rest with a future race and a more advanced science.

RAILROAD VALUATION AND RATES. By Mark Wymond. Chicago: Wymond & Clark, 1916. 8vo.; 344 pp. Price, $1.50.

In order to lead the reader up to a vantage point from which the field of railroad valuation and rates may be intelligently surveyed, the author wisely furnishes preliminary chapters on promotion, construction, and capitalization. These correct popular misconceptions and make understandable the relationship between financing, construction, and rate-making. The treatise is unprejudiced and well-argued, and its teachings are buttressed by authentic tables of capitalization per mile operated, of operation expense and depreciation allowances, and of many other considerations which enter into this intricate subject, and which must be absorbed and digested before the student of problems and conditions can rely upon the accuracy of his conclusions.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

WAIST.—W. C. HYNARD, 39 W. 29th St., New York, N. Y. The waist has an elastic draw band secured to the back of the waist, the band extending out through openings in the sides of the waist and being disposed at the outer side of the front of the waist and free therefrom so that while the back of the waist will be held down a predetermined waist line the waist front may be adjusted up or down along the waist line to conform with the figure, the sides of the waist being adjusted along an elastic draw band to accommodate the sides of the waist to the adjusted waist front.

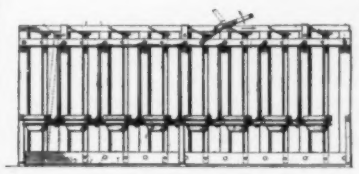
TROUSERS KNEE LIFTING DEVICE.—S. ABRAMSON, 251 Bleecker St., New York, N. Y. This invention relates to a lifting device for each leg of a pair of trousers for the purpose of automatically lifting the lower portions of the legs when the kneees are bent, as in sitting down, ascending steps, stooping and the like, whereby the objectionable bagging of the trousers legs at the knees is positively prevented and movement of the legs is unimpeded.

Electrical Devices

LEVEL.—D. W. L. FRANK, Sr., 2024 W. Harrison St., Chicago, Ill. This invention has reference to leveling instruments and aims primarily to provide a level of the illuminated vial type with means whereby the vial may be adjusted from time to time so as to always indicate the true and the correct reading.

Of Interest to Farmers

FEED RACK FOR CALVES.—M. J. HAGER, Denmark, Wis. This rack is for use particularly in feeding young calves, in which a plurality of stanchions is provided, having each associated therewith a drinking bowl, the bowls



FEED RACK FOR CALVES

being separated by partitions, whereby the animals in feeding will be practically isolated from each other and thus prevented from interfering one with another in any manner while feeding.

Of General Interest

ALUMINUM PLATING PROCESS.—F. MOENCH, Rushville, Ill. The invention provides a process for plating aluminum with tin, lead, zinc or alloys, of the same, which may be carried on in an economical manner and with very simple apparatus; provides a process of plating iron or other metals with aluminum; and provides a process which may be carried out without the use of brushes or instruments for scratching or rubbing the aluminum.

PROCESS OF RESTORING RUBBER.—F. MOENCH, Rushville, Ill. In the present patent the invention has reference generally to processes for restoring old rubber, the object being the provision of a simple and inexpensive process by means of which new life may be imparted to rubber which has deteriorated from various causes.

DISPLAY CARD.—H. L. KALISH, 78-80 Walker St., New York, N. Y. An object here is to provide a structure which effectually holds the displayed article in place. Another object is to form a display card or sheet from a single strip of material bent so as to present overlapped edges, acting as pockets for the ends of the articles being displayed upon the card or sheet.

THERMOMETER.—F. S. DICKINSON, Rutherford, N. J. This invention improves and simplifies the construction of the carrying case or sheath and its relation to the thermometer with a view to insure an automatical centering of the thermometer when placed into the case to keep the bulb end of the thermometer spaced from out of contact with the closed end of the carrying case, and to permit the quick and convenient insertion in a removal from the carrying case without danger of breaking or otherwise injuring the thermometer.

ENVELOP.—W. ZUCKERMAN, 2065 Belmont Ave., Bronx, New York, N. Y. This improvement refers to mailing envelops, and provides an envelop which will afford an easy inspection of its contents by the postal authorities and which will prevent the contents thereof from falling out during the transportation of the same in the mail.

ROPE CLAMP.—L. M. EVJEN, 703 E. 137th St., New York, N. Y. The purpose in this case is to improve and simplify the construction and operation of a rope clamp so designed that a rope can be tightly clamped without danger of slipping, and at the same time the rope is capable of being easily disconnected.

Hardware and Tools

STAY BOLT.—H. A. LACERDA, 303 Campbell Ave., Schenectady, N. Y. The object here is to provide a stay bolt for the fire boxes of boilers and similar structures, which stay bolt is easily arranged to prevent leakage and undue straining of the boiler sheets by allowing

the bolt to expand and contract, and to permit movement of the sheets in the direction of their plane without causing injury to the stay bolt.

COMBINATION MEASURING INSTRUMENT.—W. RODECK, 811 Madison St., New Durham, N. J. This invention provides an instrument for use in conjunction with an ordinary two-foot folding rule, and arranged to be used as an inside caliper or an outside caliper, or a hermaphrodite caliper, or a surface gage, or a scriber, and adapted for convenient attachment to a pocket to form a safety holder for the rule.

SOLDERING IRON.—F. MOENCH, Rushville, Ill. An object here is to provide a soldering iron by means of which soldering operations that have hitherto been considered difficult may be readily accomplished. A further object is to provide a soldering iron which is particularly adapted for soldering aluminum, and by the use of which aluminum soldering may be rendered easy.

Household Utilities

SASH CORD ATTACHMENT.—P. HEIN, 444 East 79th St., New York, N. Y. Among the objects of the invention is the provision of a novel anchoring means for the end of the cord to the window sash, such anchoring means being adapted to be put in place or changed without disturbing the window sash or frame surrounding it.

BISCUIT CUTTER.—W. H. SCHERFFIUS, 303 West Southside Boulevard, Muskogee, Okla. This improvement relates to biscuit cutters, and the main object thereof is to provide a utensil, by means of which large numbers of circular or otherwise shaped portions may be quickly cut from a slab of dough, said utensil being used in the manner of a rolling-pin.

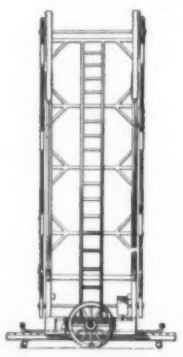
MEASURING ATTACHMENT FOR CAN COVERS.—G. T. ENGLUND, Miami, Ariz. The invention provides a can closure with an extensible arm carrying a bowl, dipper, or spoon, whereby measured quantities of the contents of the can may be taken out as needed, the arm being in the form of a pair of telescoping sections capable of being collapsed in order that the cover may be put in position on its can.

COMBINATION IRONING BOARD AND STEP LADDER.—H. HARRIED, 730 South Maple St., Spokane, Wash. This invention relates more particularly to an improved combined ironing board and step ladder and sleeve board. It provides a board which may be adapted for use either as an ironing board or as a step ladder by merely shifting the board bodily from one position to another.

Machines and Mechanical Devices

PRINTING PRESS.—J. E. RATHBUN, 8 Dutch St., New York, N. Y. This invention provides means for operating the inking carriage of a "job" printing press to augment the dwell period in the operation of said carriage; provides means for suspending the operation of said carriage and to avoid wear of the carriage-operating connecting member; and increases the out-put of the press by increasing the speed of the operation thereof.

MACHINE FOR LOWERING LUMBER.—J. A. PETERMAN, Franklin, La. This invention relates to machines for lowering lumber or other material from the tops of stacks or



MACHINE FOR LOWERING LUMBER

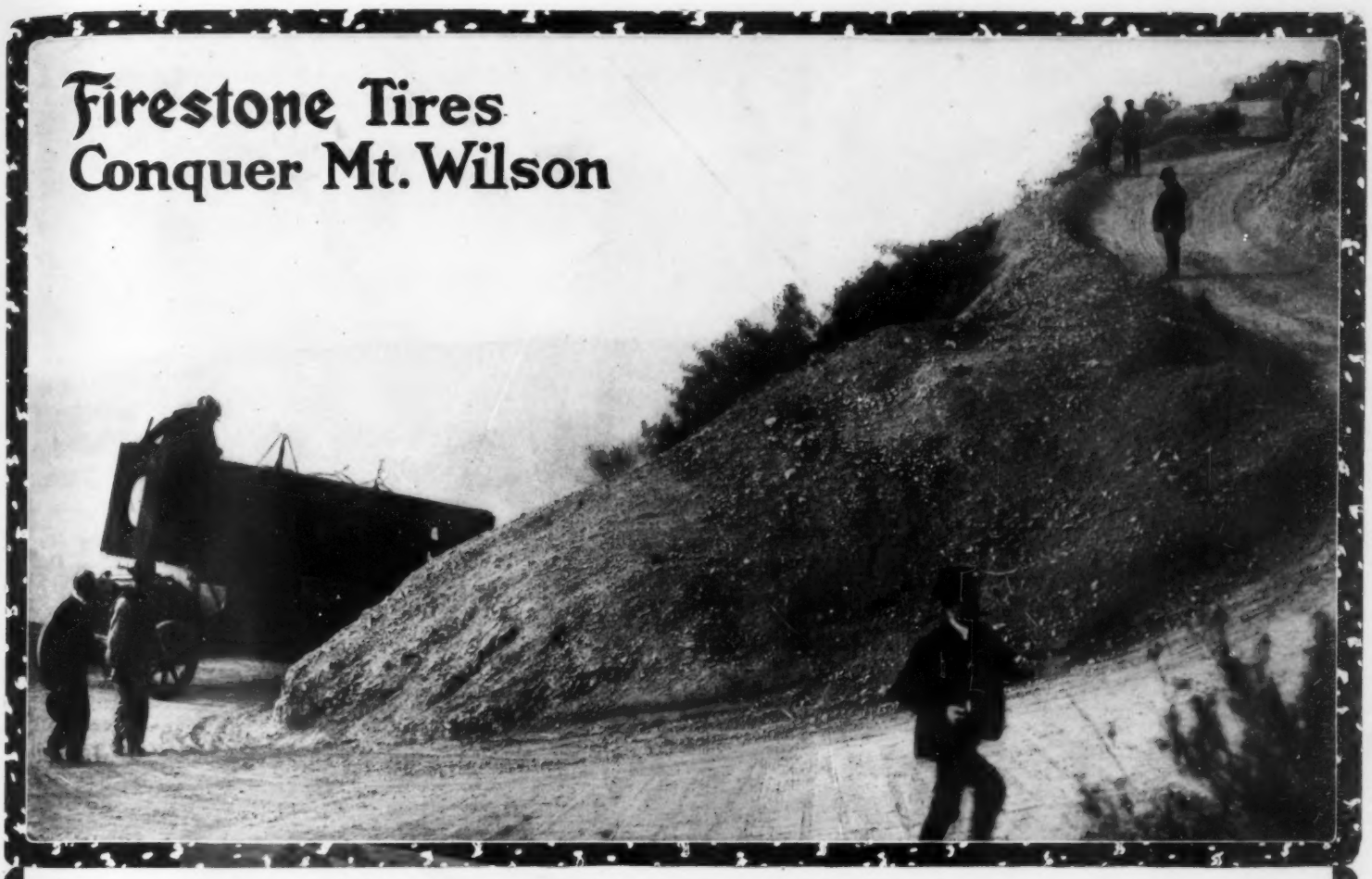
piles of the same. It provides a portable machine which may be moved from one place to another in a lumber yard, and which is particularly adapted for use in lowering the lumber from the tops of stacks.

SAUSAGE MACHINE.—J. C. SMITH and S. A. DARNELL, care of A. D. Davis Packing Co., Inc., 105 South Royal St., Mobile, Ala. The invention provides a machine adapted for simultaneously operating upon a series of rolls of sausage, of that type known as "wiener-wurst," or the like for dividing the several rolls into links of a predetermined length, by subjecting the roll at predetermined points to a twisting movement on its long axis, whereby to divide the roll into links.

Designs

DESIGN FOR A CARPET OR RUG.—J. G. PEGEL. Address G. S. Squire, care of the Bigelow-Hartford Carpet Co., 25 Madison Ave., New York, N. Y. In this ornamental design for a carpet or rug the border is composed of a heavy mass of beautifully connected leaves and flowers, and the center comprises attractive features in scroll and flower work.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



Pulling 13 Tons of Steel Up a Nine-mile Mountain Trail—Using the World's Toughest Tires to Build the World's Largest Telescope

—And Finish 100 Per Cent Good!

Almost without a scratch Firestone Tires came out of this tremendous trial! Nine miles of zig-zag climbing over a rocky trail where precipitous cliffs made skidding a fatal possibility. But the Firestones didn't skid.

Weight on Back Tires

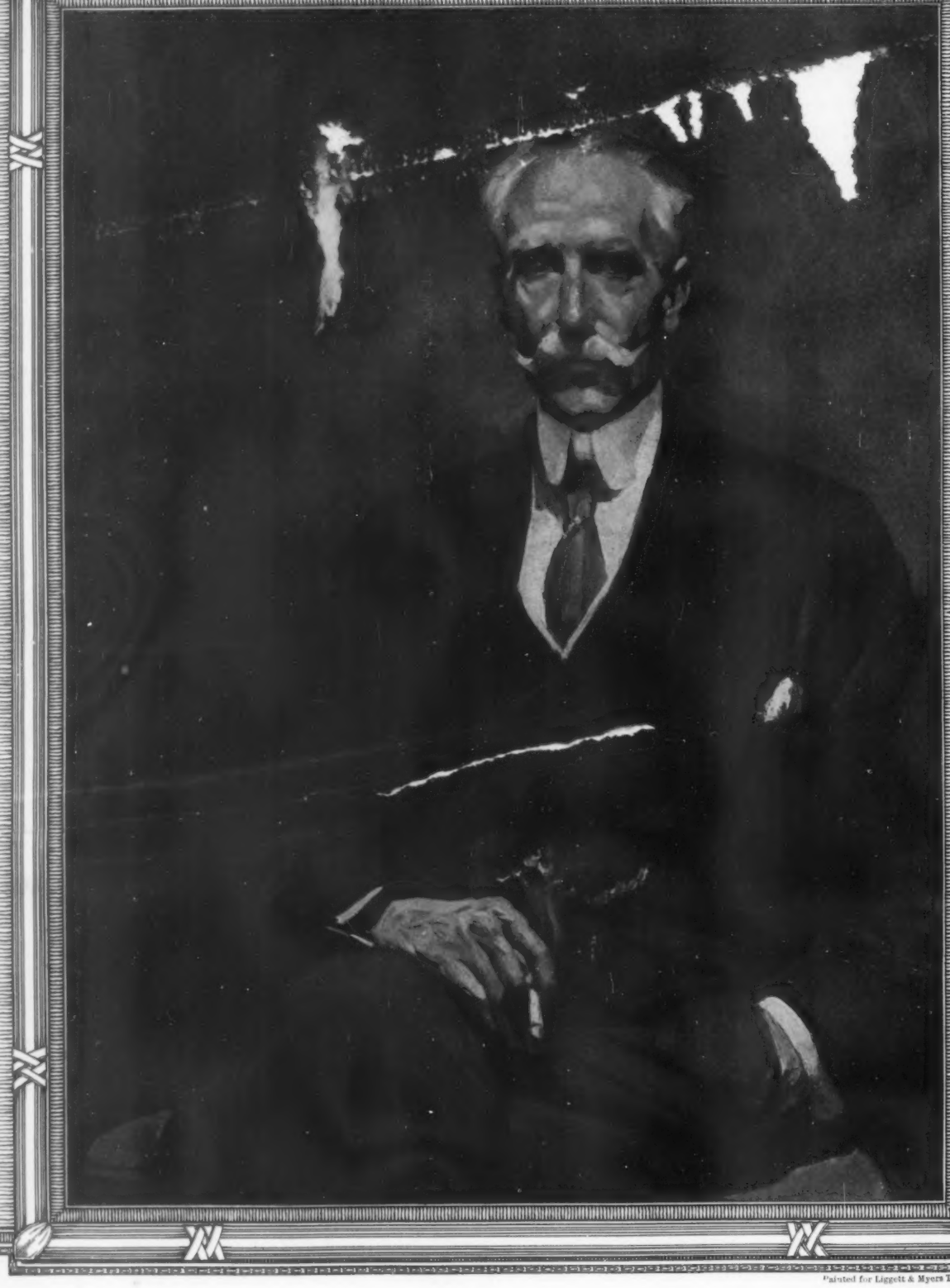
The strain of the overhang was terrific—4 tons on the rear. In many places the weight of truck and girder (16½ tons) rested wholly on rear tires—and all made worse by the gritty grind of granite.

Send for illustrated folder with details of this interesting test. It proves how ordinary work is easy for Firestone equipment.

Firestone Trailer Tires—Extra tough and strong, all styles and sizes.

Firestone Tire and Rubber Company
"America's Largest Exclusive Tire and Rim Makers"
Akron, Ohio—Branches and Dealers Everywhere

Firestone



Painted for Liggett & Myers Tobacco Co.

HIS CIGARETTE may or may not be a Fatima. But only a few years ago, if you recall, it would have seemed strange to see a man of affairs smoke a cigarette of any kind.

Cigarettes are the *mildest* form of smoking. That is why they appeal today to so many men of this type—men who force success by *clear thinking*.

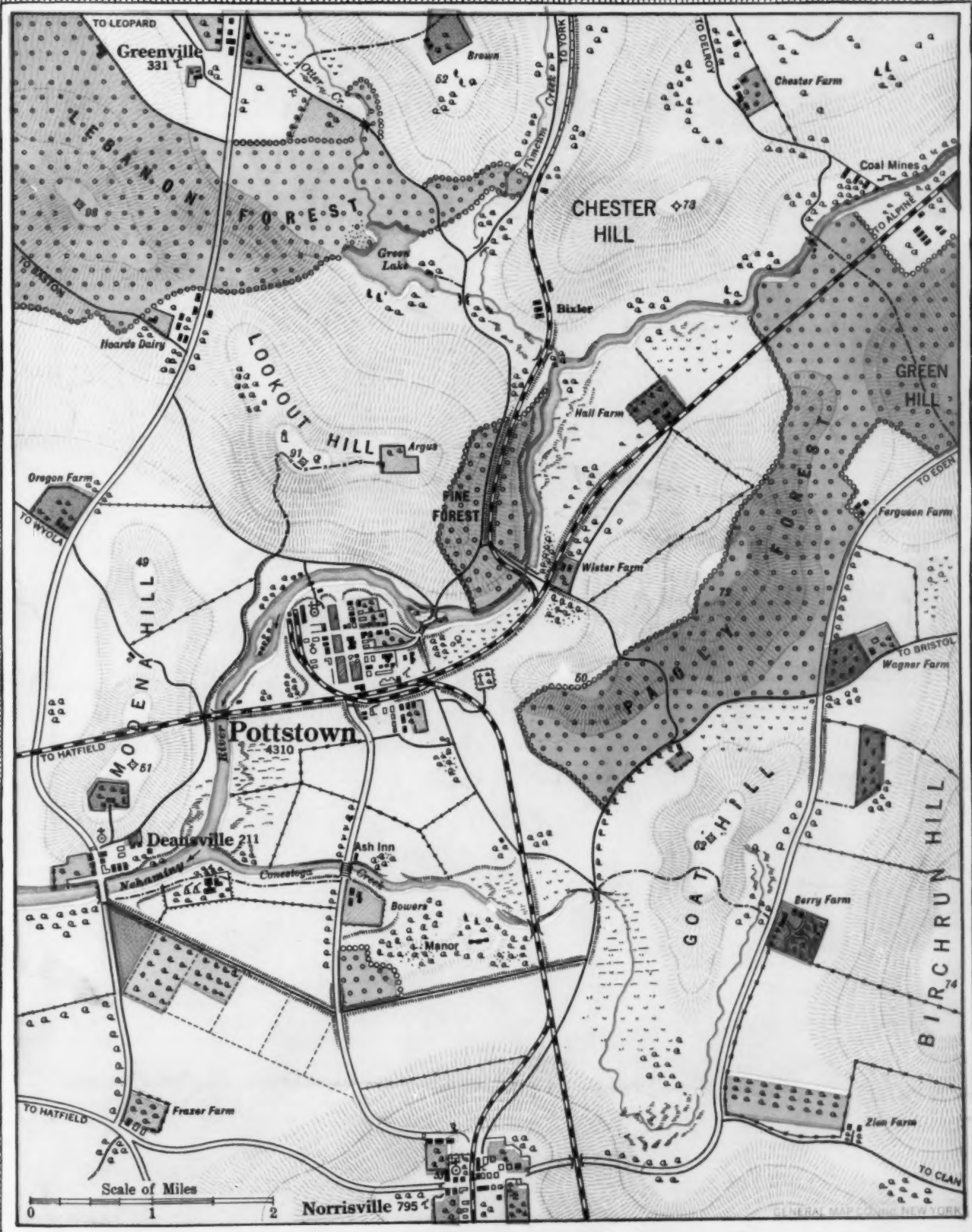
And, because Fatimas are so truly a SENSIBLE cigarette, they are day by day becoming the chosen smoke of more and more men of this calibre.

Liggett & Myers Tobacco Co.

FATIMA

A Sensible Cigarette

SCIENTIFIC AMERICAN



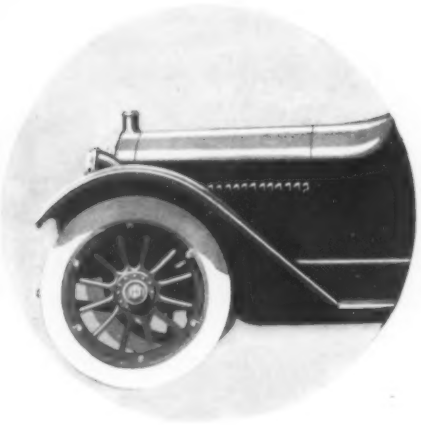
Map of the imaginary region in which the Scientific American War Game is being played.—(See Page 328.)

March 25, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Hupmobile



THE Hupmobile—with its clean, simple, powerful, four-cylinder motor—furnishes all the elements most desired in motor car performance:—

Rapidity of pick-up, flexibility, and pulling power on high gear; smoothness, silence, and absence of vibration at any speed.

These characteristics, and its consistent economy, explain why old owners remain steadfastly loyal, and why the Hupmobile market is steadily widening among those seeking a quality car.

Let us prove that we are justified in our belief that "the Hupmobile is the best car of its class in the world."

Hupp Motor Car Corporation, Detroit, Mich.

Each purchasher of a Hupmobile receives, without extra cost, a book of coupons, good for 50 hours of service-labor on his car at any Hupmobile service station. Of these there are now approximately 3300 on main-traveled roads, and Hupmobile service is available in all parts of the United States and Canada.

Five-passenger Touring Car	$1085	Two-passenger Roadster	$1085	Seven-passenger Touring Car	$1225
Year-'Round Touring Car	1185	Year-'Round Coupe	1165	Prices F. O. B., Detroit	

Courtesy First—Safety for Others in Motoring

The mark of superior H *motor car service*